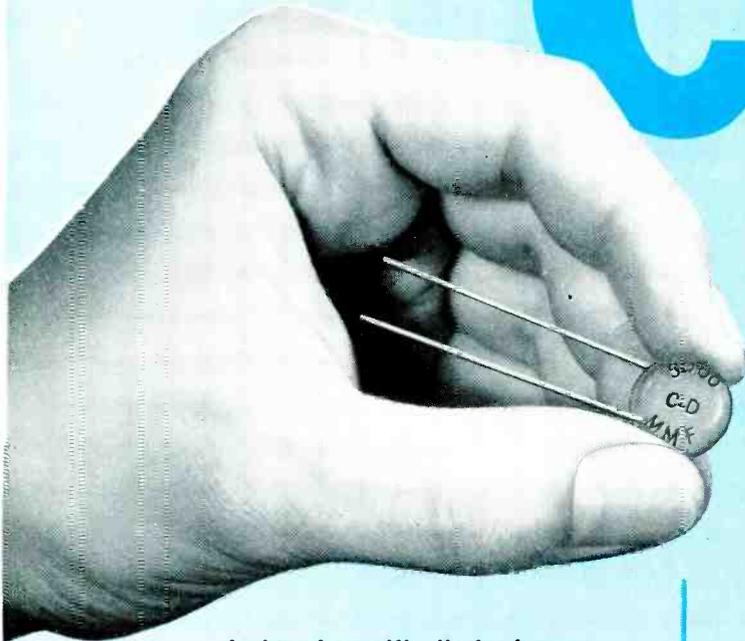




only

# C-D

## TINY MIKE<sup>®</sup>



# CERAMIC DISC CAPACITORS

*designed specifically for bypass and coupling applications*

Here's why high-efficiency, low-cost, C-D Miniature Ceramic Disc Capacitors have won immediate acceptance throughout the field.

- Exclusive TINYMIKE<sup>®</sup> construction results in maximum dependability.
- Special TINYMIKE<sup>®</sup> shape provides short, wide current path.
- Parallel leads—another C-D first—produces lowest possible inductance, providing leads are kept short.
- Wire leads, connected directly to high purity silver electrodes result in low series resistance.
- Accurately positioned electrodes result in highest capacity with minimum eddy current losses and high Q.
- Special phenolic coating insulates capacitor against shorts to ground.
- High-temperature wax impregnation—exclusive with C-D TINYMIKES<sup>®</sup>—provides maximum humidity seal.

Insist on C-D TINYMIKE<sup>®</sup> Ceramics—the better ceramic proved best by field test!

Write for catalog. CORNELL-DUBILIER ELECTRIC CORPORATION, Dept. S110, South Plainfield, New Jersey. Other plants in New Bedford, Brookline and Worcester, Mass.; Providence, R. I.; Indianapolis, Ind.; and subsidiary, The Radiart Corp., Cleveland, Ohio.

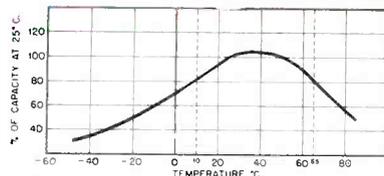
See your Classified Phone Book for nearest jobber.

**GIVE YOU:**

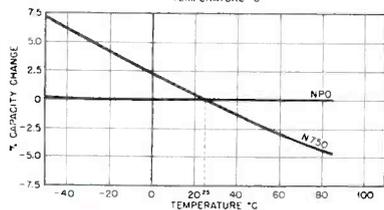
- LOWEST POSSIBLE INDUCTANCE**
- HIGH LEVEL SHUNT RESISTANCE**
- MINIMUM EDDY CURRENT LOSSES**
- MAXIMUM Q**

*now available from 50 to 5,000 mmf. at your C-D jobber*

TYPICAL CURVE  
CAPACITY CHANGE  
VS.  
TEMPERATURE  
5000 MMFD. MINIMUM  
GUARANTEED VALUE



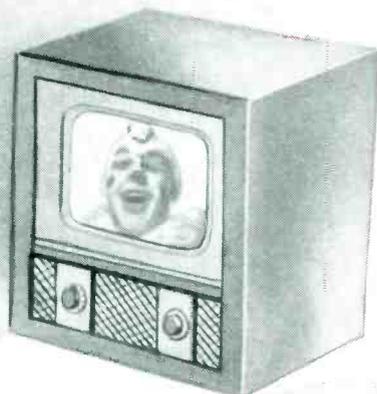
TYPICAL CURVE  
TEMPERATURE  
COMPENSATING  
UNITS  
CAPACITY CHANGE  
VS.  
TEMPERATURE



CONSISTENTLY DEPENDABLE  
**CORNELL-DUBILIER**  
CAPACITORS • VIBRATORS • ANTENNAS • CONVERTERS



..... "Sells for me...  
**BIG!**"



"G.E.'s the hottest name in tubes.  
 My turnover is evidence."



**NOW...full page G-E tube ads**

**IN "LIFE" AND THE "SAT. EVE. POST"!**

Another big boost to your sales! Millions of radio-TV owners are reading, in national magazines, the dramatic story of G-E tube leadership. YOU benefit!

"THIS handy tube merchandiser has the G-E monogram *big* on top . . . illuminated, too. That's why it makes buyers out of callers—turns my tube stock into cash for a mighty fine profit showing!" You hear this everywhere from radio-TV servicemen who have given the green light to G-E product popularity . . . And General Electric's success pattern for dealers is so easy to follow! Waiting for you is the attractive new 200-tube Selector-Salesman shown here. Ask your G-E tube distributor how to obtain one; then rub your eyes as tubes become dollars, faster than ever before! . . . Other G-E colorful displays and signs, hard-hitting promotion pieces, high-voltage advertising aids—all are ready to help you SELL. Phone, wire, or write your distributor today! *Electronics Department, General Electric Company, Schenectady 5, New York.*

*You can put your confidence in—*

**GENERAL  ELECTRIC**  
181-JAG



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Including *Radio Merchandising* and *Television Merchandising*.  
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Mid-West Representative: Stuart J. Osten, 333 N. Michigan Ave., Chicago 1, Ill. Telephone: Dearborn 2-3507  
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Pacific Coast Representative: Brand & Brand, 1052 W. Sixth St., Los Angeles 14, Calif. Telephone: Michigan 1732  
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More light on the  
radio tube situation . . .

## AN OPEN LETTER TO RADIO SERVICE DEALERS

**SYLVANIA** ELECTRIC PRODUCTS INC.

IMPERIUM • PENNSYLVANIA

First of all, we want to thank all of you good service dealer friends for your loyalty and cooperation.

Here are the FACTS: Even before the Korean trouble, the increasing demand for Sylvania Tubes was keeping our factories on round-the-clock production schedules. With the meteoric growth of television, still greater production facilities were needed.

Since the Korean war a flurry of buying by industrial customers and the service industry alike soon reduced warehouse and factory stocks to an all-time low.

Here's how Sylvania protects you now: To make certain that all of its regular service dealer customers are protected in this period of limited supply, Sylvania has effected a three-fold program of protection.

1. Production facilities have been greatly increased. Two additional plants have already been placed in operation. Another is under construction.
2. Your Sylvania radio and television tube suppliers are now being taken care of on an allocation plan, which we feel is established on the fairest possible basis.
3. Sylvania will continue to supply you with complete technical information for your service work, including latest data on substitution of available types for critical types.

Sylvania realizes that in the months ahead the whole country will depend upon you service dealers to keep its radios, TV sets and communications equipment in top working order. Your Sylvania Distributor will not have all the tubes you want but will do his best to serve you. We feel a deep obligation to give you the greatest possible aid in doing this job, but naturally, our country's defense needs come first.

As we have demonstrated in the past, Sylvania is ever mindful of the importance of its Service Dealers and servicemen to the nation and to the industry. We will continue to do everything possible to preserve the fine relationship existing between Sylvania, its distributors, and you, its loyal dealer customers.

Cordially yours,  
SYLVANIA ELECTRIC PRODUCTS INC.

*H. H. Rainier*  
Manager, Distributor Sales

INCANDESCENT LAMPS • RADIO TUBES • FLUORESCENT LAMPS AND FIXTURES • ELECTRONIC DEVICES



*The finest solder made  
for all television and radio work  
... Everything Electrical*

# Kester Solder

Kester Plastic Rosin-Core and Kester "Resin-Five" Core Solders are recognized by the trade as outstanding for the finest type of radio, television and electrical work.

Kester Solders are made only from newly mined grade A tin and virgin lead. Fluxes chemically correct.

# Uniform

Only highly skilled craftsmen are employed by the Kester Solder Company. Flux formulas and specifications are rigidly adhered to for perfect uniformity.

# Efficient

Making Kester Solder is an exact science from the raw material to the finished product. Everyone knows and prefers Kester because it can be relied upon to do the job right every time, even under the most difficult soldering conditions.

## **KESTER MAKES GOOD SOLDERING EASY**

The wise serviceman insists upon Kester Solder from his jobber. By using Kester, the solder used in making the original equipment, he will do his best work.

EASIER TO USE  
MADE FROM VIRGIN METALS  
FASTER  
ELIMINATES REJECTS  
DEPENDABLE  
SAVES TIME

*Kester... Standard for the TV and Radio Fields*

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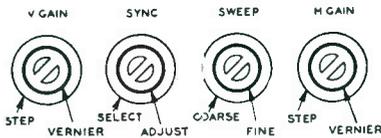
**KESTER  
SOLDER**



# Announcing a 7" TV 'scope...

## RCA WO-56A

### DUAL CONTROLS FOR "COARSE" AND "FINE" ADJUSTMENTS



No hunting or fumbling for controls when adjusting Vertical Amplifier Gain, Sweep Frequency, Sync Injection, and Horizontal Amplifier Gain.



**ONLY**  
**\$197<sup>50</sup>**  
Suggested User Price

Includes set of matched probes and cables (direct probe and cable, low-capacitance probe and ground lead)

### FEATURING —

- Giant RCA 7JP1 cathode-ray tube.
- Direct-coupled, 3-stage, push-pull, vertical and horizontal amplifiers.
- Frequency-compensated and voltage calibrated attenuators on both amplifiers.
- A set of matched probes and cables.
- Panel-source of 3 volts peak-to-peak calibrating voltage.
- Identical vertical and horizontal amplifiers with equal phase-shift characteristics.
- Retractable light shield for convenience and visibility.
- New green graph screen with finely ruled calibrations.
- Magnetic metal shield enclosing CR tube to minimize hum-pickup from internal fields.

### SPECIFICATIONS—

- Deflection Sensitivity: 10 rms millivolts per inch.
- Frequency Response: Flat within -2 db from dc to 500 kc; within -6 db at 1 Mc-useful beyond 2 Mc.
- Input Capacitance: Less than 10 uuf with WG-216A Low-Capacitance Probe.
- Square-Wave Response: Zero tilt and overshoot using dc input position. Less than 2% tilt and overshoot using ac input position.
- Linear Sweep: 3 to 30,000 cps with fast retrace.
- Trace Expansion: 3 times screen diameter in vertical and horizontal axis, with 3 times centering control.
- Size 13 3/4" h, 9" w, 16 1/2" d. Weight only 31 pounds (approx.)

### ADVANCED SWEEP FACILITIES—

- Preset fixed sweep positions for vertical and horizontal television waveforms.
- Positive and negative syncing for easy lock-in of upright or inverted pulse waveforms.
- 60-cycle phase-controlled sweep and synchronizing.

Built for laboratory, factory, or shop use, the WO-56A combines the advantages of high-sensitivity and wide-frequency range in a *very small* instrument with a *large* cathode-ray tube.

Designed with the user in mind, this new 'scope can be depended upon to provide sharp, bright, large, and accurate pictures of minute voltage waveforms over the entire useful surface of the 7JP1 screen.

The direct-coupled amplifiers are provided with ac positions so that measurements can be made with or without the effects of any dc component.

Square-wave reproduction is excellent, whether the application is low-frequency TV sweep-alignment or observation of high-frequency steep-fronted sync and deflection waveforms.

The excellent linearity and fast retrace of the sweep or time base are functions of the Potter-type oscillator and the undistorted reproduction of the sawtooth by the wide-band horizontal amplifier. The preset-fixed positions provide rapid switching between vertical and horizontal waveforms in TV circuits.

Truly, the WO-56A is a most useful and practical instrument for everyday work in the fields of television, radio, ultra-sonics, audio, and a wide array of industrial applications.

For details, see your RCA Distributor, or write RCA, Commercial Engineering, Section K56Y, Harrison, N.J.



**RADIO CORPORATION of AMERICA**  
TEST EQUIPMENT  
HARRISON, N. J.



# TV Sweep Generator with MIRROR-SCALE MARKER

**MODEL 3434**  
for quick checks in all stages

Large Marker dial has a mirror scale for easier reading and reset accuracy. Straight line frequency tuning condensers provide linear scale markings. No "SKIPS" in frequency—continuously variable Sweep width control. Triplett-engineered shielding—all critical circuits enclosed. Copper plated steel construction. All these features (see Tech. Data) combined with the two built-in markers for simultaneous use set Model 3434 apart as one of the fundamental contributions to the rapid, accurate and profitable Servicing of Television.

## TECH DATA

### Frequency Coverage:

- SWEEP CENTER FREQUENCY  
Range 1— 0-60 MC  
Range 2— 60-120 MC  
Range 3—120-240 MC
- SWEEP WIDTH:  
0-12 MC (Continuously Variable)
- MARKER FREQUENCY  
19.5 to 40 MC (fundamental), 39 MC to 240 MC (harmonic)
- CRYSTAL FREQUENCIES  
To 20 MC on Fundamentals, Harmonics up to 216 MC. (Crystals Not Furnished)
- MODULATION  
400 Cycle on both Crystal and Marker Frequencies
- AUDIO:  
400 cycles

The steel case is finished in black suede baked enamel, size 15 11/32"x11 1/32"x8 1/4". Leather handle. Panel is black, white and red etched on aluminum. Copper plated feet for grounding.



ONLY \$169.50 AT YOUR DISTRIBUTOR  
(MODEL 3435 WITHOUT BUILT-IN MARKER, \$99.50 NET)

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

# Triplett

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • BLUFFTON, OHIO, U.S.A.

# Satisfy

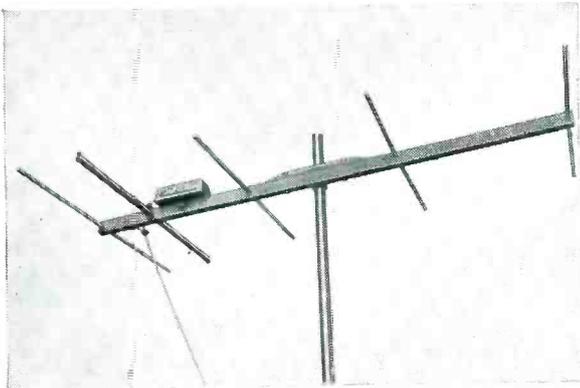
fringe area customers

quickly, easily,

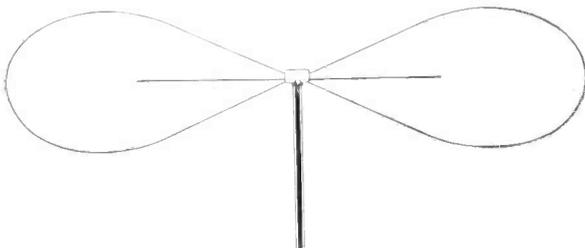
permanently, with the



## TEL-A-RAY ANTENNA-MOUNTED PRE-AMPLIFIER



### the butterfly



For primary installations, your best choice is still the Tel-a-Ray Butterfly — the quality antenna that sells for \$2.95 (suggested list). The Butterfly receives all 13 channels and FM, completely guaranteed against weather damage, can be erected in 20 seconds. Order your supply today!

Here is an amazing new development that will help you satisfy your fringe area customers quickly and easily — and give them strong, clear, “snow”-free TV reception. The Tel-a-Ray Pre-Amplifier can be mounted to any folded dipole-type antenna in 30 seconds to:

- eliminate or greatly reduce “snow”
- deliver more signal with less noise because of high signal-to-noise ratio
- provide up to 300 times gain over the dipole (when Tel-a-Ray Model T antenna is used)
- furnish consistent reception beyond the fringes
- eliminate matching problem and loss

The Tel-a-Ray Pre-Amplifier will give your customers good strong images wherever even the faintest image is present. And it means fewer callbacks for you because Tel-a-Ray completely guarantees the Pre-Amplifier to be weather-resistant, durable, lasting.

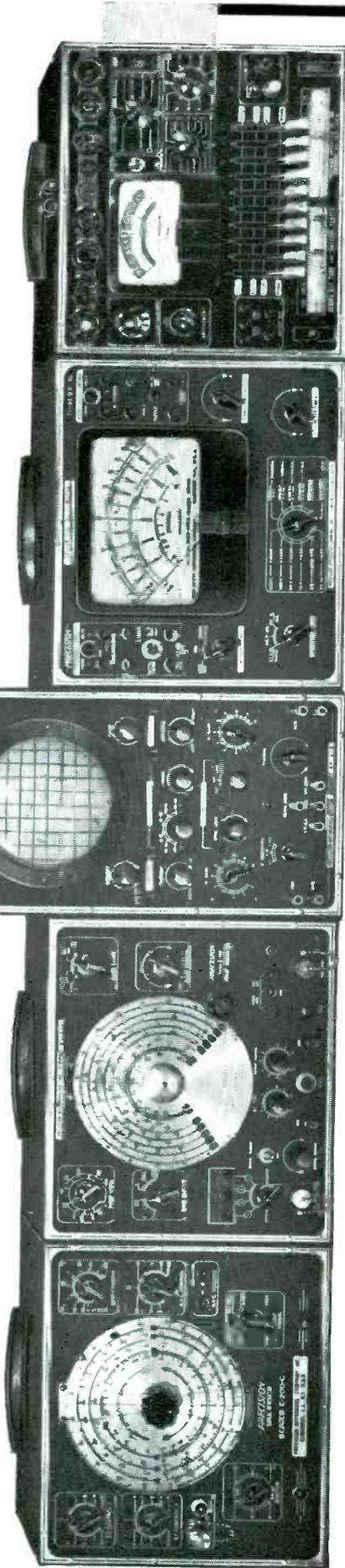
*Write today for complete information*

**Tel-a-Ray**  
**ENTERPRISES, INC.**  
**BOX 332S HENDERSON, KY.**

**★ Build Your Service-  
Sales Future on a Firm  
Foundation with . . . . .**

**PRECISION**  
TEST EQUIPMENT  
*Standard of Accuracy...*

**...These 5 Matched "Precision"  
Instruments provide a Complete  
MODERN SERVICE LABORATORY for  
TV-FM-AM at only moderate cost.**



**SERIES E-200-C**—Modern Multi-band SIGNAL and MARKER GENERATOR for A.M., F.M., and TV alignment.

Exceptional Accuracy and Stability! 1000 pt. vernier calibrating scale! 0-100% Modulation! A.V.C. substitution network! Direct reading 88KC to 120 MCI Complete with output cable and tech. manual. In matched, heavy gauge case 10 1/2 x 12 x 6".

Net Price:—\$71.25

**SERIES E-400**—Wide Range H.F. SWEEP SIGNAL GENERATOR Direct Reading from 2 to 480 MC.

Narrow and Wide Band Sweep for F.M. and TV • 1500 pt. vernier calibrating scale • Multiple Crystal Marker • 8 tubes including V.R. and rectifier • RG/62U Coaxial Terminated Output. Complete with 2 crystals. In heavy copper-plated case 10 1/2 x 12 x 6".

Net Price:—\$134.50

**SERIES ES-500**—20 MV. High Sensitivity Wide Range 5 inch C.R. OSCILLOGRAPH.

V. Amp. Response to 1 MCI Low C. High R input Step Attenuator! Z axis modulation Terminal! 9 tubes incl. V.R. and 2 rectifiers! Complete with light shield and mask. Heavy steel case 8 1/2 x 14 1/2 x 18".

Net Price:—\$159.50

**SERIES EV-10**—True Zero-Center VTVM — MEGOHMMETER with large 7" meter — plus complete 1000 Ω/V. functions.

59 ranges to 6000 Volts, 2000 Megs., ±70DB, 12 A.m.s. • Voltage Regulated bridge type circuit • Constant 13 1/2 Megs input resistance to 600 V. 133 1/2 Megs at 6000 V • Optional RF probe. Complete with test cables. Matched heavy gauge steel cabinet 10 1/2 x 12 x 6".

Net Price:—\$94.50

**SERIES 612**—Modern Free-point Cathode Conductance TUBE TESTER, and dynamic A-B-C Battery Tester.

Incorporates RMA recommended circuit principles! 10 lever free-point element selection! Built-in roller chart! Dual short-check sensitivity! Noise, Ballast and Pilot Test! Complete, ready to operate. In matched heavy gauge steel cabinet 10 1/2 x 12 x 6".

Net Price:—\$69.75

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**PANEL MOUNTS, PORTABLES, COUNTER TYPES**

Most "Precision" instruments are available in various enclosure styles to suit your individual application, field or shop. WRITE FOR OUR LATEST ILLUSTRATED CATALOG describing the full line of Precision quality test equipment for all phases of modern radio, television and communications.

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Extends range of Series EV-10 (above) up to 30 KV or 60 KV direct reading, with full safety to operator and equipment. Multiplier cartridges available to match most VTVM's and 20,000 ohms/√V test sets.

Complete with 30 KV multiplier cartridge for EV-10.

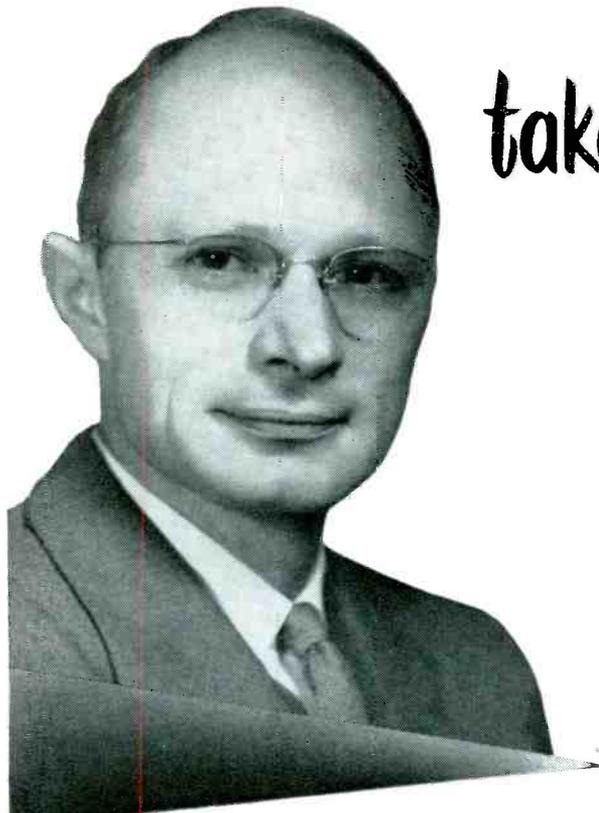
Net Price:—\$14.75



Convenient "Precision" Purchase Terms can be arranged with your favorite authorized Precision Distributor.

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take it from **EXPERTS**

renew  
with **N.U.**  
premium quality tubes

**PAT REID SAYS:**

Salesmanager, United Radio Supply, Inc.  
Portland and Eugene, Oregon

"Our 379 servicemen and dealers tell us N. U. tubes are best, because their own experience has proved N. U. tubes are reliable, uniform, and above all are properly designed for interchangeability. What's more, costly call-backs are minimized by N. U.'s proven quality control. That's why we've featured N. U. tubes for 15 years. They mean good business for all of us.

- RADIO AND TELEVISION RECEIVING TUBES
- VIDEOTRON TELEVISION PICTURE TUBES
- PANEL LAMPS
- TRANSMITTING AND SPECIAL PURPOSE TUBES



**NATIONAL UNION RADIO CORP.**

Main Office: 350 Scotland Rd., Orange, N. J.

Research Division: Orange, N. J. • Plants: Newark, N. J. — Hatboro, Pa.

*..this letter speaks for itself!*

**Admiral Corporation**

SERVICE DIVISION  
201 E. NORTH WATER STREET - CHICAGO 11 - TELEPHONE MOHARR 4-4822

Mr. Mel Buehring  
Simpson Electric Company  
5200 West Kinzie Street  
Chicago 44, Illinois

Dear Mel:

This is to tell you how delighted we are here at Admiral with the new Model 303 Simpson Vacuum Tube Volt-Ohmmeter. It certainly is a versatile instrument for television servicing.

The large meter is very legible, and yet the instrument itself is a compact size. I particularly like the AC voltage range, which is the widest I've ever seen on this type of instrument.

Our service engineers think you've done a good job on the Operator's Manual, too, because it is both complete and concise.

Of course, we've used the Simpson Model 260 Volt-Ohm-Milliammeter for years. The "303" is a fine companion instrument to the "260".

Congratulations!

Sincerely yours,

*M. J. Schinke*  
ADMIRAL CORPORATION  
M. J. Schinke  
National Service Manager

MJS:ar

WORLD'S LARGEST MANUFACTURERS OF RADIO PHOTOGRAPHS WITH AUTOMATIC RECORDING  
AR-FM Batches • Television • Radio Photographs • Micrographs • X-ray Prints



**Model 303  
VACUUM TUBE  
VOLT-OHMMETER**



**SPECIFICATIONS**

**DC Voltage**

Ranges 1.2, 12, 60, 300, 1200 (30,000 with Accessory High Voltage Probe)  
Input Resistance 10 megohms for all ranges  
DC Probe with one megohm isolating resistor Polarity reversing switch

**Ohms** Ranges 1000 (10 ohms center)  
100,000 (1000 ohms center)  
1 megohm (10,000 ohms center)  
10 megohms (100,000 ohms center)  
1000 megohms (10 megohms center)

**AC Voltage**

Ranges 1.2, 12, 60, 300, 1200  
Impedance (with cable) approx. 200 mms shunted by 275,000 ohms

**AF Voltage**

Ranges 1.2, 12, 60  
Frequency Response Flat to 100,000 cycles

**Decibels**

Ranges -20 to +3, -10 to +23, +4 to +37,  
+18 to +51, +30 to +63

Zero Power Level 1 M. W., 600 ohms

**Galvanometer**

Zero center for FM discriminator alignment and other galvanometer applications

**R. F. Voltage**

(Signal tracing with Accessory High Frequency Crystal Probe)  
Range 20 volts maximum  
Frequency Flat 20 KC to 100 M.C.  
105-125 V., 60 cycles

**Size**

5 1/4" x 7" x 3 1/4" (bakelite case). Weight: 4 lbs.  
Shipping Wt.: 6 1/2 lbs.

**Dealer's Net Price**

Model 303, including DCV Probe, ACV-Ohms probe and Ground Lead—\$58.75;  
Accessory High Frequency Probe, \$7.50;  
Accessory High Voltage Probe, \$14.85  
Also available with roll top case,  
Model 303RT—\$66.70

**Simpson ELECTRIC COMPANY**

5200 WEST KINZIE STREET, CHICAGO 44, ILLINOIS • IN CANADA: BACH-SIMPSON, LTD., LONDON, ONTARIO

Phone: COLUMBUS 1-1221

NOW...in all G-E Variable Reluctance Cartridges...at no extra cost!



# "BATON" STYLUS

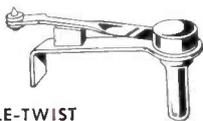


## An Exciting New Discovery in High Fidelity Reproduction!

THERE'S terrific sales appeal—as well as listening pleasure—in this revolutionary General Electric Stylus! Like a baton in the hands of a skilled symphony conductor, it brings out the full tonal quality of recorded music as you've never heard it before!

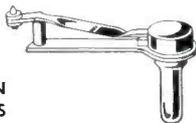
Its feather-light tip, on the end of a dual-twist cantilever arm, follows every curve and dip of the record groove with a compliance so delicate it picks up frequencies through 10,000 cycles per second! The blasting, buzz, and hum so annoying in most record reproduction are virtually wiped out. Above all—the tone fidelity of the Baton Stylus is unsurpassed by any other commercially available unit! Equipped with diamond or sapphire tip, it fits any G-E replaceable stylus cartridge.

### HOW COMPLIANT CAN A NEEDLE BE?



SINGLE-TWIST STYLUS

Until the development of the Baton Stylus, this model afforded unsurpassed fidelity. The single-twist arm and single damping block were designed for a tracking pressure of 21 grams. It was recognized, however, that lighter pressure would lengthen both record life and stylus life.



BATON STYLUS

Bending and twisting to every undulation of the record groove, this stylus reproduces each tone value with amazing clarity. Tracks at 6 grams—thus providing the maximum degree of compliance that may be used successfully with commercially available tone arms. Double damping blocks filter out superfluous vibrations.

### Dealers and Servicemen!

There's a big market for the Baton Stylus among present users of General Electric cartridges. Hi-fi fans and record enthusiasts everywhere will want this sensational new model in their phonograph tone arms. Be sure you get your share of this business... the coupon below can open the door to new customers, new sales, new profits.

### FREE Baton Stylus Folder!

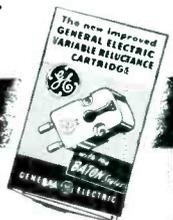
General Electric Company, Section 3110  
Electronics Park, Syracuse, New York

Send me FREE folder on the new Baton Stylus.

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CITY \_\_\_\_\_ STATE \_\_\_\_\_



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# ANCHOR is your answer!

**THE TV BOOSTERS FOR....**  
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 ... better TV reception  
 ... satisfied customers  
 ... simple, easy installations  
 ... fringe area TV sales



### The Suburbanite

ANCHOR'S SINGLE-STAGE BOOSTER—Model ARC 101-75 will increase original TV signal strength 3 times and is especially recommended for low signal areas in or near cities where there may be any number of interference problems. Assures consistently good reception up to 75 miles. **\$37.50** List Price.



### The Granger

The ANCHOR TWO-STAGE BOOSTER—Model ARC 101-100 increases original TV signal strength 5 times and is recommended for distant rural areas. Consistently good reception over 100 miles.

**\$49.50** List Price.

TELL THIS STORY TO YOUR TV SERVICE MAN OR YOUR INSTALLATION AGENCY



BE SURE YOU KNOW ALL THESE FACTS

Only ANCHOR can provide your customers with ALL of the most Ultra-Modern advantages for consistent, top-notch, long-range TV reception. Here's why!

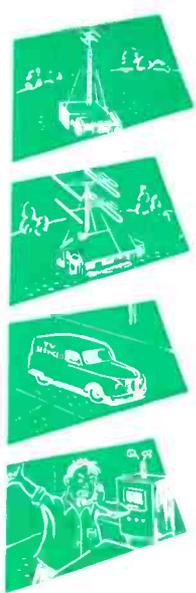
- ANCHOR has the highest gain of any TWO-STAGE BOOSTER.
- ANCHOR has the highest Signal to Noise Ratio.
- ANCHOR is the only non-regenerative unit available. The unit that is not returned.
- ANCHOR'S Single Knob Construction is so convenient for Booster is turned on and can be switched and tuned all on the same knob.
- ANCHOR'S New and Revolutionary method of construction of the RF Stage (Pat. Pend.) is the only real engineering advance in Boosters in recent years.
- ANCHOR'S TWO-STAGE BOOSTER is modernly styled with streamlined plastic escutcheon, soft mahogany leatherette finish.
- IMPORTANT ANCHOR'S TWO-STAGE BOOSTER is often the answer to installation difficulties well within the normal TV areas where their New Single Stage Model fails to give complete satisfaction.

Expensive high towers—still unsatisfactory reception.

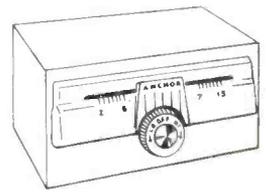
Hazardous installations subject to damage and repair.

Many trips to repair or maintain faulty installation.

Dissatisfied customer complaints costly.



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- ONE SALE
- ONE UNIT
- ONE CALL
- ONE satisfied customer.

If you are a dealer and have your own service men who make the installations on the TV sets you sell, it stands to reason that an installation of one of the many fine simple-to-install antennas, plus an ANCHOR BOOSTER will make a faster and more profitable installation for you, or your service agency, as well as a completely satisfied customer. REMEMBER, return calls due to dissatisfaction cost you money. **SERVICE MEN: take an ANCHOR BOOSTER with you on every installation.**

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### Sparkling Sound

SOUND, for nearly three decades, has been a grand faithful friend of all Service Men, affording an endless stream of rich opportunities. Since the days of the three-foot paper cones, resourceful Service Men have found that sound always appeared to offer that satisfying answer to the dull-day problems, whether they occurred in the summer or winter.

With the advent of improved *ems* and *pms* and acoustically engineered enclosures, sound's virtues began to attract the interests of many, and it wasn't long before quite a few of the folks at home became sound fans. And with the development of huskier hi-output hi-fi speakers for public-address installations, the business of sound took a real spurt. As the years rolled by, sound specialists continued to produce not only better equipment, but a variety of accessories which could be used in scores of ways to provide quality reproduction, as well as truer recording. Today, sound activity is keener than ever. Acoustic research and development has become one of the major factors in the world of sound, and as a result, we have a galaxy of audio devices for every conceivable requirement. There are a host of unusual speakers now available for the home or the *pa* system, such as coax two way or single voice-coil types, low-frequency and high-frequency drivers, as well as horns, reflex trumpets, tweeters and crossover networks, to provide that hi-fi result, for which every set owner—TV, FM or AM—or those interested in large-area coverage, are prospects. And to the list can be added the many new types of cartridge reproducers which have been designed to produce quality reproduction on disc recordings of the long-play or standard cut, or even the foreign pressings. So that the European records, with their variable characteristics, can be played properly, there are record compensators. In one type, which can be used with any record-playing system using magnetic cartridges and an amplifier employing a high-gain preamp, six-position compensation is provided for all types of records, including old noisy ones, in which the objectionable hiss can be

removed. Plug-in heads for triple-play application represent another interesting contribution to the parade of developments which have been placed in the better sound kit of the Service Man, a kit which also includes replacement needles, using metal, osmium, sapphire or diamond styli of .001 micro-groove, .003 standard or truncated design. Available today also are an excellent assortment of amplifiers, output transformers, loudness controls, two and three-player mechanisms, as well as tape and wire units, all of which can provide Mr. and Mrs. Consumer with stirring recording and reproducing results.

In surveying the application possibilities of sound, one finds an extensive array of prospects. For instance, in addition to the installation of new or revised phono systems, involving new pickups, needles, tone arms, motors, speaker chambers and speakers, or recording and playback setups of either the disc, or wire or tape types, there are the amplifying systems of the radio or TV chassis, which merit consideration. The latter type of operation is receiving more and more attention in the Service Shop. The boys have found that most owners of the table TV models with their four and five-inch speakers, usually facing downward or on the side, mounted within an area cluttered with metal enclosures, realize that the quality can be improved if a console type of system is provided. As a result, larger speakers in well-designed cabinets are being installed in many a TV home. Where space limitations have prohibited the use of a console, bookcases, closets, desks, and even closet doors have been used as mounts for the speakers. To demonstrate the effectiveness of large speakers, Service Men have built up portable sound-system kits and arranged for home demonstrations, following the pattern employed by many of the boys to sell better sound to those with standard broadcast or even FM receivers. The FM set market, incidentally, has also proved to be a perfect one for the demonstration plan.

The striking sound reproduction possible from the average FM chassis, when a hi-fi type of speaker, properly baffled, is installed, together with per-

haps a modified amplifier, has been a revelation to many. The lifelike reproduction, with the sudden appearance of *all* the instruments, when the hi-fi system is switched in, has been found so dramatic, that rarely has anyone been willing to revert to the old small speaker system.

The installation and servicing of *pa* sound systems, an old reliable project of many Service Men, continues to be a lively field on many fronts. Actually the Service Man engaged in *pa* work is in a preferred position to pick up sales of additional equipment, and in many instances secure valuable leads that can result in the replacing of worn out or obsolete sound setups. It must be remembered too, that even during rentals, a Service Man is required for he must operate the equipment. This activity normally results in extending contacts. There are also many opportunities to rent equipment to supplement overloaded systems. Incidentally, it has been found that the average electrician employed to run wiring and install some sound systems is totally unfamiliar with the equipment. Thus it is up to the Service Man to step on to the scene and supervise the installation. This operation actually offers an opportunity to secure a contract for the servicing of the equipment. According to some distributors, although some installations are made by members of a trade's union, no difficulty arises when the Service Man, who is non-union, supervises, since he is in reality acting in an advisory capacity. Thus, regardless of the trade problem, it appears as if the Service Man can find a spot for himself.

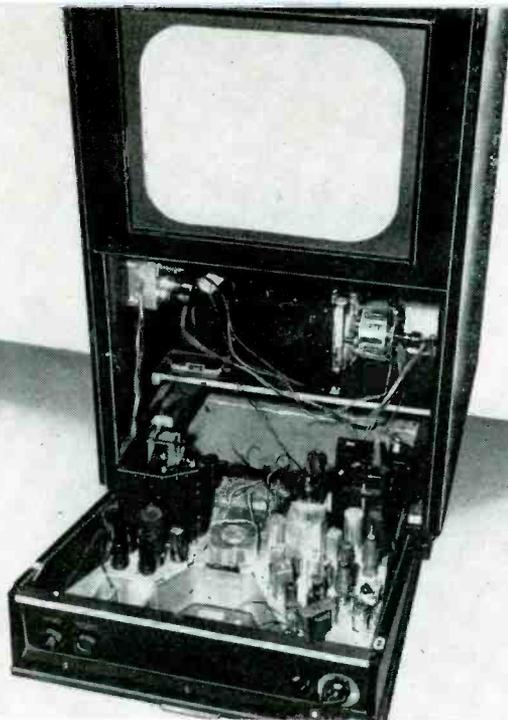
In the early years of *pa* work, the installation possibilities were somewhat restricted, because of the limited types of speakers available. Today, the picture is quite different. With the development, for instance, of hazardous-duty type speakers, systems can now be installed in such places as paint plants, tank farms, textile mills, lino-leum factories, fireworks plants, match factories, refineries, chemical plants, etc.

At home or in the field, there's a need for that better sound system, which every Service Man can provide!—L.W.

# Conversion to

[See Front Cover]

by **JOSEPH RACKER** and **PHILIP SELVAGGI**



DURING THE PAST YEAR or so emphasis has been placed upon the larger screen TV sets. Many owners of older sets with relatively small screens, influenced by the big-screen advertisements and seeing 16- and 19-inch models at their neighbors, have become big-picture conscious and quite interested in any plan that might convert their set for large screen operation.

Conversion may be accomplished in one of two ways. One is to use a larger tube, such as the 16 or 19-inch, in place of the present one. The second is to employ projection techniques using for instance, one of the kits recently placed on the market.

## 16 and 19 Inch Conversion

All conversions employ the same basic principles, involving, in the main, the sweep and high-voltage circuits of the picture tube. Pictures are

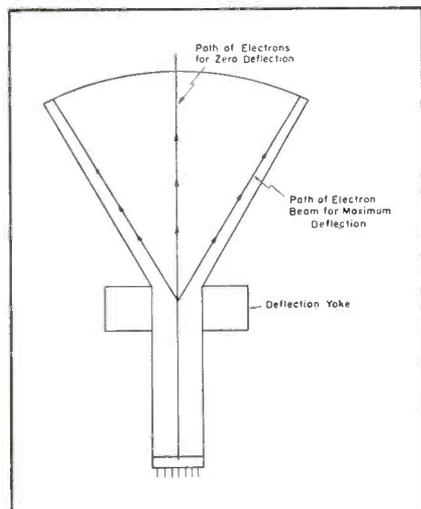
produced upon the face of the tube by a stream of electrons striking the screen while being swept back and forth by appropriate sweep circuits.

The action in a typical tube is illustrated in Fig. 1. The electrons stream is generated by the electron gun and forwarded toward the screen at a velocity that is a function of the anode potential. The higher this velocity, the brighter the picture on the screen.

The deflection coil, located around the neck of the tube, deflects the beam from one end to the other in accordance with the sweep current applied through it. Sufficient deflection must be effected by these coils to swing the electron beam to the extreme ends of the tube. The amount of deflection is a function of the stream velocity (high voltage), type of coil used, and amplitude of driving current.

Now let us consider the action of the high voltage and sweep circuits, shown in Fig. 1, when they are applied to a larger tube, an effect shown in Fig. 2. In this case, because of the longer path to be traversed, the size of the picture would be increased. It is because of this effect that some Service Men have been able to substitute a 16-inch tube for a 10-inch tube directly, without any circuit modifications.

However, because of the longer path, the beam will not strike the screen with the same velocity and hence the picture will not be as bright. Furthermore the sweep-driving circuit must be operated at their peak value and are likely to be non-linear under these conditions. If the high voltage is increased to get more brightness, the deflection angle will decrease and picture will no longer cover the entire screen. Hence, the procedure of substituting a 16-inch tube for a



(Left)

Fig. 1. Illustration showing how electrons sweep the face of a picture tube.

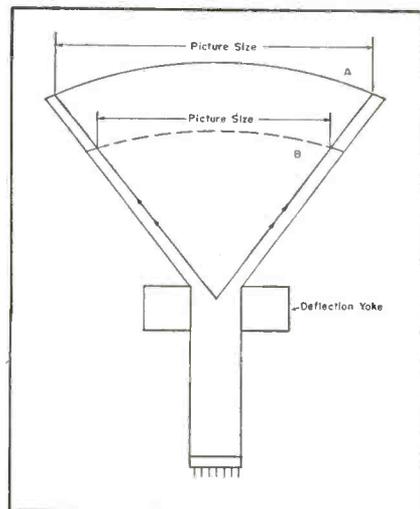
(Right)

Fig. 2. How a larger picture can be obtained from a large tube (a) by using the same deflection and high voltage as in the smaller tube (b).

(Above)

A projection-type setup, using a special enlarging kit.

(Courtesy North American Philips)



# LARGE-SCREEN TV

**Practical Methods Which Can Be Used to Convert 10-Inch Chassis to 12-Inch, and Larger Types Up to 19-Inch Through the Use of Modified Sweep and High-Voltage Circuits, Involving the Application of Wider Deflection Circuits, 6CD6G Driving Tubes Instead of 6BG6s and Voltage-Doubler Techniques . . . How to Arrange for Mechanical Changes on the Chassis and in the Cabinet . . . Use of Projection Systems Which Provide Up to 30 by 40 Inch Pictures From a 10-Inch Tube.**

10-inch directly is *not recommended* and has led to many difficulties. If this solution were a sound one, all set manufacturers would use it. However, as is well known, manufacturers use different high voltage, sweep and deflection circuits for larger tube sets.

From the foregoing it is obvious that two requirements must be satisfied to obtain correct electron sweep; both the high voltage and angle of deflection must be increased. To effect these requirements, it has been found that four steps must be taken:

- (1) Proper type deflection yokes must be used.
- (2) Matching between driver tube and deflection coil must be effected.
- (3) Sufficient driving current

through deflection coil must be available.

(4) Proper value of high voltage must be supplied.

The assumption has been made that magnetic deflection circuits are available. Most sets meet this requirement, but there are a number of old 7-inch sets that employ electrostatic deflection. Conversion of an electrostatic tube to a larger magnetic type is a relatively *complex* and *expensive* operation and is *therefore not considered practical*. To use magnetic deflection a special power supply must be built that is required to deliver a large current, supplying around 50 watts of power to the deflection circuits alone. In addition, the focus coil will require approximately 100 ma

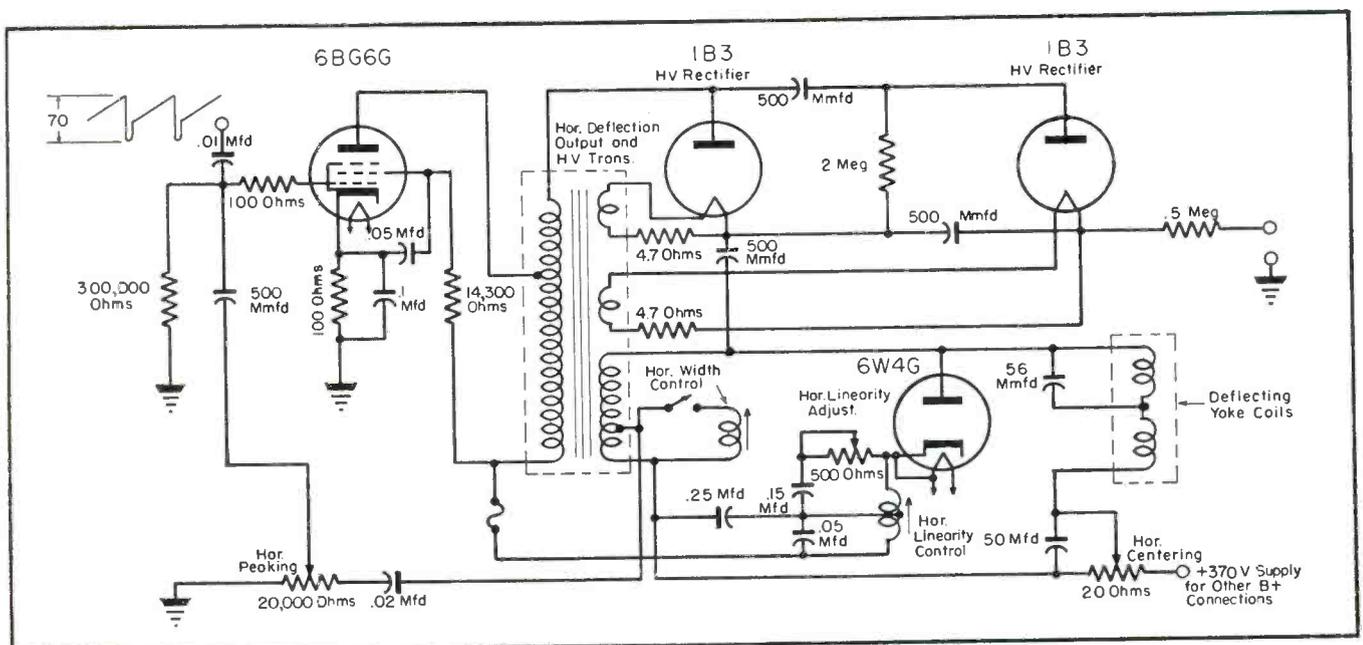
and the horizontal driving tube about 120 ma. A considerable amount of space is needed to place all the additional transformers and coils. Thus, all in all, it is not a worthwhile project!

Most of the 10-inch tubes have a deflection angle of 50 degrees. The 10BP4, for example, has a deflection angle of 50° and operates normally with 9,000 volts on the anode. However, the yokes used in 10-inch sets are often designed to accommodate tubes with higher deflection angles. One yoke, for instance, can be used for tubes having a 1 7/16" neck and

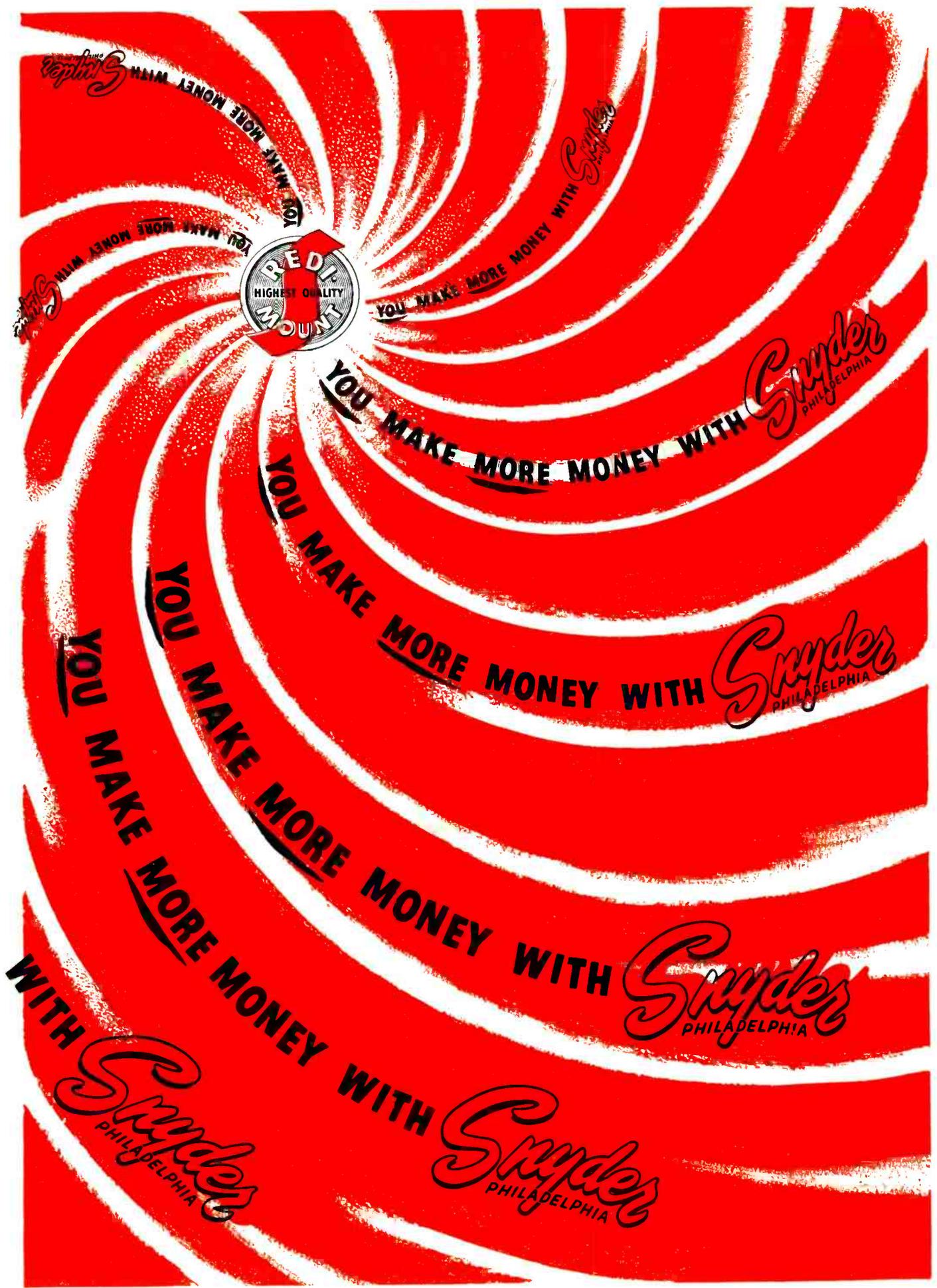
*(Continued on page 73; see page 16 for projection-system circuit.)*

1RCA 201D12.

Fig. 3. Circuit of deflection system using a high-voltage doubler.







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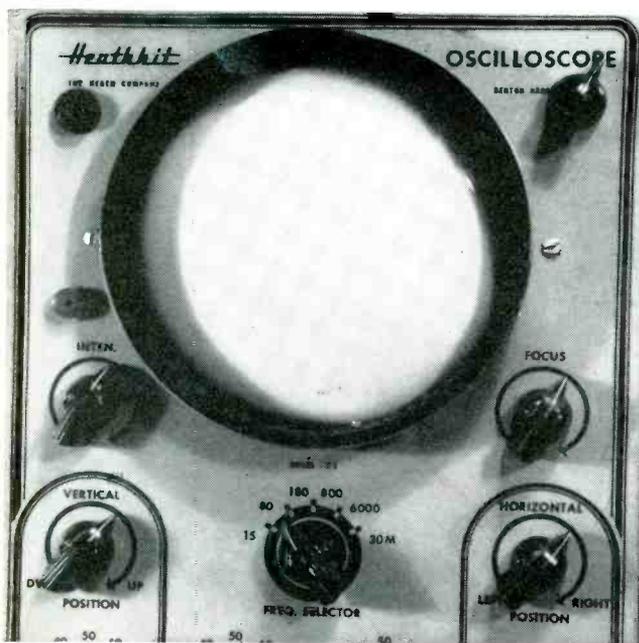


Fig. 1. View of scope with the dual triode-generator mounted on 'scope chassis, powered by the 'scope's supply. Input and output jacks appear at left of crt and control at right.

# A One-Tube SQUARE-WAVE GENERATOR

by RICHARD H. DORF

## Dual-Triode Instrument, Using an Aperiodic Flip-Flop Circuit, Provides Amplifier Frequency-Response Efficiency Information Through Square-Wave Patterns on 'Scope.

SERVICE MEN who have to make tests on audio amplifiers and on the audio sections of high-quality FM, AM, and television receivers have been finding more and more that the old *tried and true* test procedures are not necessarily the best. The high-fidelity enthusiast has found that intermodulation measurements, for example, are usually far more revealing than harmonic distortion tests. And the Service-Man whose time is his bread and butter, has discovered that the old way of finding an amplifier's frequency response can be replaced by square-wave testing.

The drawback that has confined square-wave measurements to a comparatively few service shops has been the difficulty of generating a really good square wave by the usual method. Ordinarily, a sine wave is fed to a series of clippers and amplifiers. The clippers place a flat top on each wave, but reduce the amplitude greatly and leave the sides of the wave sloping. Following amplifiers make the slope steeper, after which the wave is clipped again. Several stages of this kind produce a wave with very good flattops; but theoretically, the sloping sides of the sine wave can never be made really vertical. In practice they

become nearly so, enough for most purposes.

To approach a desirably steep wave-front, several costly and space-consuming amplifier and clipper stages must be used. Since each must operate over a wide band to keep the top flat and the sides steep, additional noise is introduced in every stage.

Another and much better approach to the problem is to actually *generate* a square wave with a circuit designed for the purpose, such as a multivibrator. The difficulty here is that the frequency of a multi-vibrator is very unstable. It can be synchronized by application of a signal from an external generator of the usual type, but unless there is some provision for varying the values of the circuit components, the multivibrator will work over only a very limited frequency range. Its range need not, of course, be as great as that of a sine-wave test generator, but at least two frequencies should be available, one at about 300 and the other in the neighborhood of 3,000 cycles.

### The Flip-Flop Circuit

The Eccles-Jordan flip-flop circuit has afforded a close approach to the solution of the square-wave problem. In this system there are a pair of

tubes employing mutual positive feedback, much like a multivibrator. It does not oscillate, however, but arranged so that in a stable condition one of the tubes is cut off while the other is drawing plate current. Each negative pulse applied simultaneously to both grids from an external source *swaps* the conditions; the tube that was conducting suddenly cuts off and the other suddenly conducts. Output taken from either tube is a series of excellent square waves composed of the alternate conducting and nonconducting periods of the tube. The transition from one condition to the other is very fast; it is approximately a switching action, and thus the wave-front is very steep, almost invisible on a 'scope, with the brilliance control at the usual setting. Since output is taken from only one of the two tubes, the frequency of the output is one-half that of the input negative pulses.

This circuit is somewhat frequency-sensitive, however, and the frequency division is not always desirable. In addition, high-amplitude negative pulses are not available from an audio service generator.

An idea for the ultimate solution was found in a patent<sup>1</sup> issued in '49 to Nicholas Langer. The inventor described an electronic musical instrument employing cascaded frequency dividers, using the principles of the Eccles-Jordan circuit and making it *aperiodic*. The flip-flop in this patent can be operated over the entire audio-frequency range and up through the ultrasonics without a change in the

<sup>1</sup>No. 2,486,039 assigned to Central Commercial Co., Chicago.

Fig. 1a. Dual-triode modified flip-flop circuit.

component values. It does divide frequency in half, however, and a further modification has been found necessary to make the output frequency the same as that of the input.

In the circuit, shown in Fig. 1a, two to five volts of sine-wave audio of any frequency are necessary at the input. This can be furnished by a standard test oscillator. (It will be noted that negative pulses are *not* required.) The output is a constant 2.5 volts of perfectly square wave, or as nearly perfect as the state of the art permits, to quote the FCC. In Fig. 2 appears a 'scope photo of the output wave at 400 cycles. The tops are perfectly flat and the sides are practically invisible. (The nonuniformity in wavetop thickness was caused by the single-ended 'scope amplifier.)

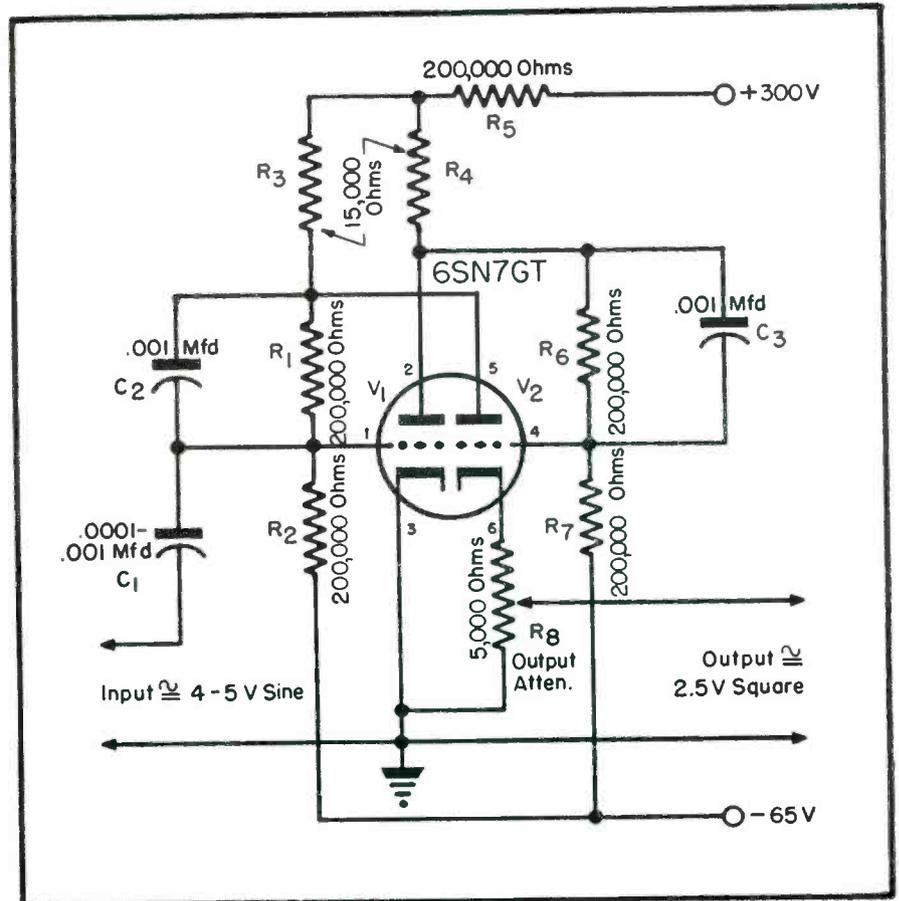
The wave of Fig. 2 is practically symmetrical, but a simple adjustment in the circuit yields waves with any desired percentage pulse width, though the width will change somewhat with wide frequency changes.

### Theory of Operation

When power is first turned on, the circuit almost immediately reaches a state of equilibrium in which both tubes are conducting weakly. About 2 ma is drawn by both tubes and the voltage at each plate is about 60. There is some difference between the two due to the 5000-ohm output attenuator,  $R_8$ , which gives some cathode bias, but the difference is not important.

Because of the direct coupling, each grid is somewhat positive. The 65-volt negative C-supply overbalances this, however, placing the grids at a net voltage sufficient to allow the total 2-ma plate current. (These currents and voltages may vary, but they are not critical.)

When a sine wave is applied to the input, the first alternation may be a positive one. Reaching the grid of the  $V_1$  section of the 6SN7GT, it drives the grid more positive and increases



the plate current, which produces a pulse of negative voltage at the  $V_1$  plate. This plate is coupled to the grid of  $V_2$ , which, receiving the negative pulse, goes nearer to cutoff. As a result, a positive pulse appears at the plate of  $V_2$ , which is coupled back to the grid of  $V_1$ . This positive pulse reinforces the positive alternation from the sine-wave input, so that the whole action cycle described is greatly accentuated, reaching an end only when  $V_2$  is at cutoff and  $V_1$  is at saturation. The action takes place in a very short time and produces the steep sides of the wave shown in Fig. 2.

The cutoff of  $V_2$  and saturation of  $V_1$  continues for the duration of the positive alternation of the input sine wave. That creates a flat top for the output wave.

The next sine-wave alternation is a

negative one. At its start, the grid of  $V_1$  falls slightly from saturation. As a result, there is a small positive pulse at its plate. Transferred to the grid of  $V_2$ , the positive pulse creates a negative pulse at the  $V_2$  plate. This, transferred to the grid of  $V_1$ , accentuates the effect of the negative sine-wave alternation. The feedback action again occurs in a very short time, stopping only when  $V_1$  is cut off and  $V_2$  is at saturation. For the remainder of the negative alternation, conditions are quiet, making the flat top for the negative alternation of the output square wave.

Output is taken from the 5,000-ohm attenuator,  $R_8$ . The cathode resistor makes for a slight asymmetry, which can be seen in Fig. 2 as the small difference in steepness of the leading and trailing edges. It is worth while, how-  
(Continued on page 67)

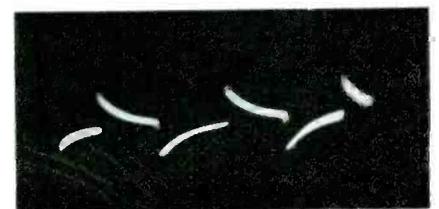
Fig. 2. Photo of scope pattern, revealing the almost perfectly squared waves.



Fig. 3. Rounded wave pattern illustrating poor treble response.



Fig. 4. Sloping wavetops which mean deficient bass.

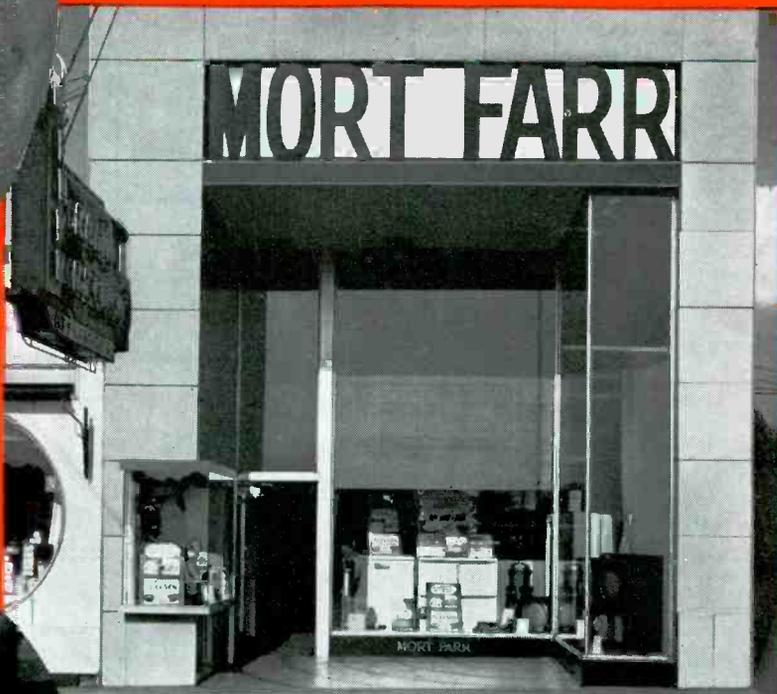




**"OUR SERVICE BUSINESS HAS INCREASED CONSIDERABLY, DUE TO THE INFLUENCE OF THE RAYTHEON BONDED DEALER PROGRAM" . . . says** *Mort Farr*

Right: Mort Farr's modern, well equipped establishment in Upper Darby, Pennsylvania.

Below: Service dealers in the Philadelphia area get dependable personalized attention from Almo Radio Company, exclusive Raytheon tube distributors. Pictured is Al Margolis of Almo, checking an order with Mort Farr (right).



Customer confidence is the key to volume service business. The RAYTHEON *Bonded* ELECTRONIC TECHNICIAN PROGRAM provides this vital asset for Mort Farr, just as it does for thousands of other dealers who have adopted this exclusive Raytheon business builder. Raytheon Radio and Television Tubes help, too, because Raytheons are Right . . . for Sound and Sight! Every time a worn out tube is replaced with a Raytheon, the service dealer gains another satisfied customer.

What the Raytheon Bonded Program does for Mort Farr it can do for you! Ask your RAYTHEON distributor how you can become a *Bonded* ELECTRONIC TECHNICIAN . . . how you can get your Television and Radio service backed by the bond that creates customer confidence in you and your work. If you qualify, it's yours at no cost to you—the Bonded Program is *Raytheon's Investment In Your Future.*



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Newton, Mass., Chicago, Ill., Atlanta, Ga., Los Angeles, Calif.

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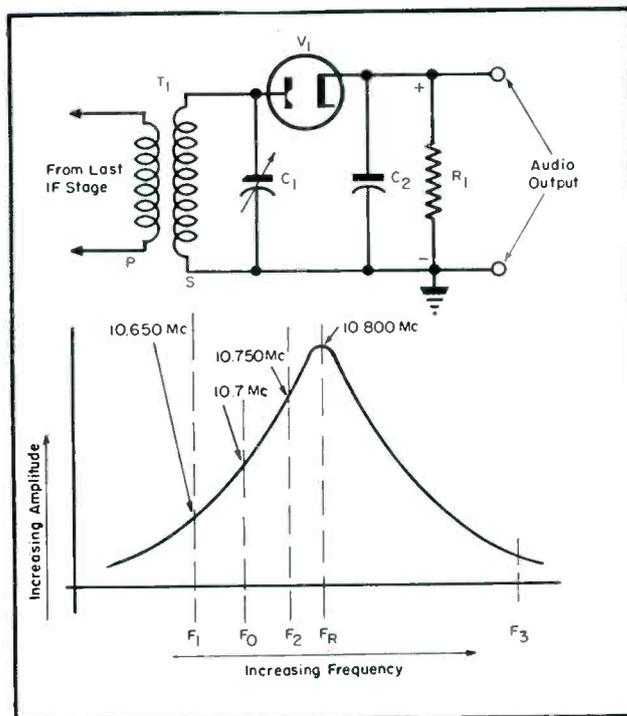
*Excellence in Electronics*

# Servicing

## FM Detectors

by **ALLAN LYTEL**  
 Temple University Technical Institute

Fig. 1. Basic AM detector circuit using a diode which has been modified for use as an FM or slope detector.



FREQUENCY-MODULATION detectors may be aligned and serviced by either of two methods. One method involves the use of a frequency-modulated signal generator which swings the signal over the complete 200-kc bandwidth to simulate an input FM signal to the receiver. A visual trace wherein the frequency output is plotted on the fluorescent screen of the 'scope tube is used for alignment. The second method, which can be equally successful, provided extreme care prevails, requires the use of a single-frequency signal generator (the standard AM signal generator) and a vacuum-tube voltmeter.

There are several important types of FM detectors. The most common of these are the ratio detector and the discriminator. Other types of detectors include the locked-in oscillator and the Fremodyne super-regeneration-detector.

The function and operation of the discriminator and ratio detector can be best explained in terms of the basic AM detector using the diode. This circuit, when modified for use as an FM detector, is shown in Fig. 1. It is known as the slope detector since the input signal is not at resonance with the detector tank circuit. The primary of the transformer,  $T_1$ , is linked to the last *if* stage whose frequency we may assume to be 10.7 mc. Capacitor  $C_1$  tunes the secondary to a frequency which is *not* that of the *if*. But in our example, the resonant frequency of the secondary is above 10.7 mc. In the drawing, this resonant frequency is

### Application Procedures Available For Single-Frequency Signal Generator of AM Type and VTVM To Align and Service Ratio Detector and Discriminator Type FM Detectors.

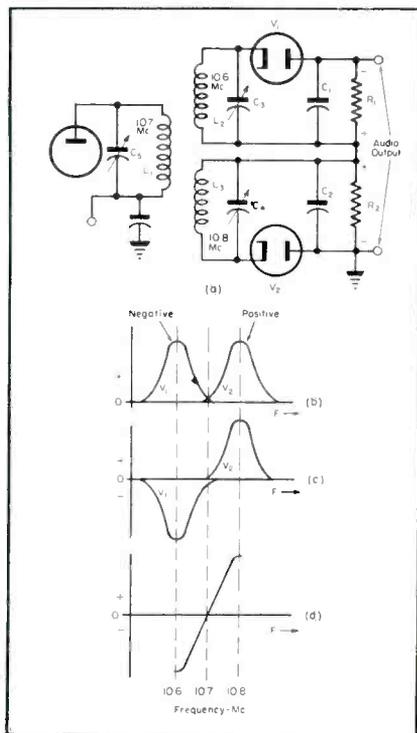
designated  $F_r$ , and we may assume that it is 100 kc above the *if* or 10.80 mc. The slope detector is usually incapable of detecting the full 200-kc bandwidth of the FM wave in a linear fashion without distortion. For this reason we must restrict the bandwidth to approximately 100 kc to operate on the linear portion of the curve.

The response curve of the tuned secondary circuit is plotted with increasing frequency to the right and increasing amplitude going up; that is, amplitude is plotted on the *Y* axis and frequency is plotted on the *X* axis. The input frequency, or 10.7 mc, is marked  $F_0$  in this figure. It is important to see that this is *not* the resonant frequency of the secondary. The diode  $V_1$  is the detector tube and its load is resistor  $R_1$ .

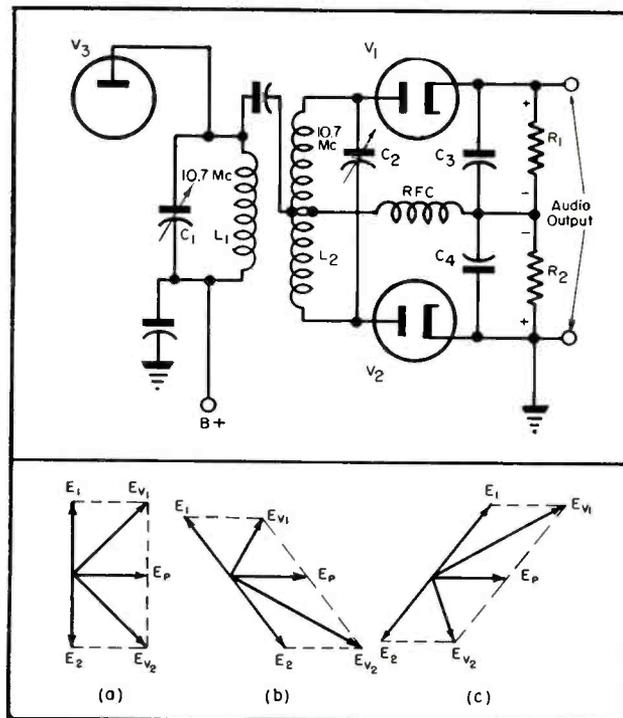
The incoming *if* signal will produce a voltage output across the resistive load, since the tube detects and rectifies when its plate is positive relative to the cathode. There will be a constant voltage output when an unmodulated FM signal is being received. As the incoming signal increases in frequency, to  $F_2$  in the figure, an increase in the voltage output will be noticed since we are now approaching the

resonant frequency of the secondary. In this manner, an *increase* in frequency will mean an *increase* in voltage output. If the incoming FM signal *decreases* in frequency to the point marked  $F_3$ , the voltage output across  $R_1$  will *increase*. The voltage output then increases or decreases depending upon frequency of the incoming FM signal. It might be said that the tuned circuit changes the FM signal into AM, after which it is detected by the rectifier and its load. The filter capacitor,  $C_2$ , filters out the *rf* pulses in the output, so that the signal across the load resistor represents *af* variations.

While the fundamental action of the slope detector is quite similar to the more advanced design of the discriminator, there are inherent limitations in the slope detector which prevent its widespread use. The limitations, in fact, will be found to be the very features which are taken care of in the operation of the discriminator. A straight-line portion of the tuning curve in the slope detector must be used to obtain an undistorted audio output. The linear portion is *not* sufficiently large to permit the full 200-kc



(Left)  
Fig. 2. A double-tuned FM detector system.



(Right)  
Fig. 3. Discriminator detection system and vector relationship plots: In *a* appears plot of input frequency at resonance; *b*, input frequency below resonance; *c*, input frequency above resonance.

bandwidth used in the 88-108 mc FM band. Only about 100 to 200 kc of the slope detector curve are sufficiently linear to be used in this manner. One-half of the entire tuning curve is only 200 kc. Even if the entire half of a curve could be used, a bandwidth of 200 kc could conceivably be accommodated in a detector of this type, but this would involve using the curved portions at the top and bottom sections of the curve. The complete 200-kc portion of the tuning curve is shown in the figure, as the frequency difference between  $F_r$  and  $F_a$ . A Service Man, who is aligning a slope detector, would have to adjust the frequency of  $C_1$  above or below the incoming *if* signal, so that the incoming signal was approximately the center of the tuning curve.

#### The Double Tuned Detector

A circuit which exhibits all of the important features of a complete FM detector, is shown in Fig. 2. The only serious defect of this circuit is its inability to prevent the passage of AM signals, which may appear on the incoming FM signal. This double-tuned circuit consists essentially of two slope detectors placed back to back. The two load resistors,  $R_1$  and  $R_2$ , are connected series-opposing. This means that if they both had equal voltage drops, the net output would be zero, since the audio signal output is obtained across these two resistors used in series.

The action of this circuit may be considered by taking each of the diodes

separately. There is a 200-kc separation between the tuning peaks of diode 1 and diode 2. As shown in the drawing, these two tuning curves slightly overlap and because of the relation of their output voltages, diode 1 produces a negative output signal and diode 2 produces a positive output signal. It is easy to understand if we take these tuning curves and plot diode 1 as a negative going output, and diode 2 as a positive going output. Since these two curves overlap slightly in the center, their combined action will produce a linear response. This is quite similar to the correction for linearity found in push-pull circuits.

Each of the diodes is tuned to resonance 100 kc away from the incoming *if* signal. This makes diode 1 resonant at 10.6 mc and diode 2 resonant at 10.8 mc, if we have an *if* signal of 10.7 mc.

The servicing techniques involved may be very easily tied in with theory of operation. If we take an ordinary AM signal generator connected to the grid of the preceding *if* stage, a *vtvm* may be connected across the load resistor of diode 1. The signal generator is now adjusted for a 10.6 mc signal output and the tuning capacitor for diode 1 is adjusted for maximum output from this circuit. The signal generator is then adjusted for an output of 10.8 mc and the tuning capacitor of diode 2 is adjusted for resonance at this frequency. A check on this alignment may be obtained by connecting the *vtvm* across both resistors in series, with a signal generator output at 10.7

mc. There should be zero voltage indicated on the meter at this frequency. The preceding *if* stage which feeds this detector should be adjusted for a maximum output at 10.7 mc which is still zero output across the two resistors forming the total load of the double tuned detector.

#### The Discriminator Detector

The double-tuned circuit which operates as two slope detectors placed back to back has been replaced in modern receivers by the discriminator. One of the reasons for the widespread use of the discriminator is its relative ease in tuning adjustments. The double-tuned circuit requires three frequency adjustments in servicing; the primary must be tuned to the *if* or 10.7 mc. Each of the secondaries must be tuned 100 kc from the *if*. One of the diodes is adjusted for 10.6 mc and the second for 10.8 mc. This involves three separate tuning adjustments on three individual frequencies with the attendant possibility of errors during servicing or alignment.

The discriminator circuit shown in Fig. 3 has the same type of output. However, it uses only one single frequency for the circuit adjustment; this is the *if* frequency of 10.7 mc. While the discriminator has the characteristic FM S-shaped output curve, its operation can be best explained by means of vectors. A voltage impressed across the primary of a tuned transformer will be 90° out of phase with the measured voltage across the secondary. This

(Continued on page 64)

# 4 MODELS

# To Fit *EVERY NEED*

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### C-D and RADIART *TELE-ROTOR*

Tested and proven to be the outstanding rotator in the field... this heavy-duty TELE-ROTOR has no equal! Powerful... rugged... it will hold and turn any antenna array under any weather conditions! Easily and quickly installed—guaranteed for trouble-free performance!

**MODEL TR-1**... Rotator and control cabinet with end of rotation light (uses 4 wire cable)  
..... **\$39.95**

**MODEL TR-2**... Rotator with "Compass Control" cabinet having illuminated "perfect pattern" dial (uses 8 wire cable)  
..... **\$44.95**

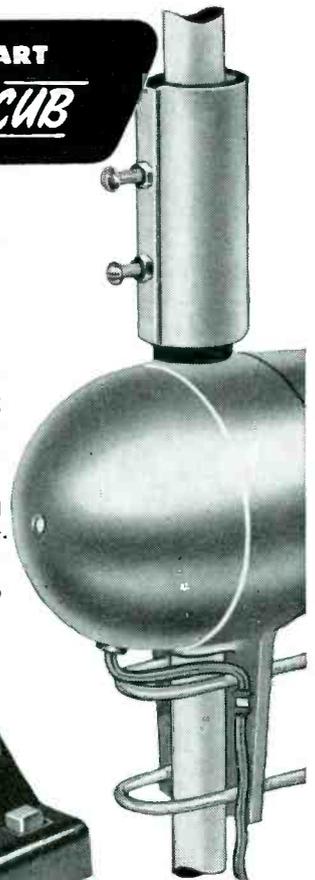
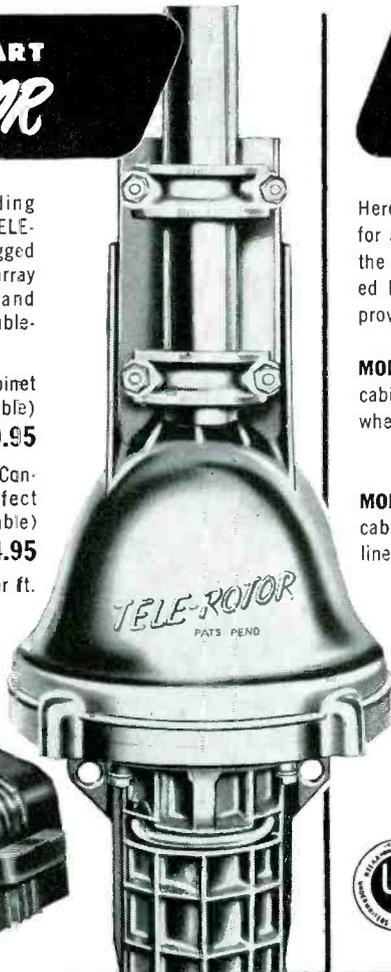
ATX-8 8 wire cable ..... 10c per ft.

### C-D and RADIART *TELE-ROTOR CUB*

Here is the standard TELE-ROTOR... for all average installations. It features the ALL IN LINE design... and is powered by the same husky motor that has proven itself in the heavy-duty models.

**MODEL 501-A**... Rotator with control cabinet and flashing light indicating when rotator turns... (uses 5 wire cable)  
..... **\$34.95**

**MODEL 502-A**... Rotator with control cabinet having indicating meter for "hair-line" tuning (uses 5 wire cable)  
..... **\$44.95**



**CORNELL-DUBILIER SOUTH PLAINFIELD, N. J.**

**THE RADIART CORPORATION CLEVELAND 2, OHIO**



# Auto Radio Remote-

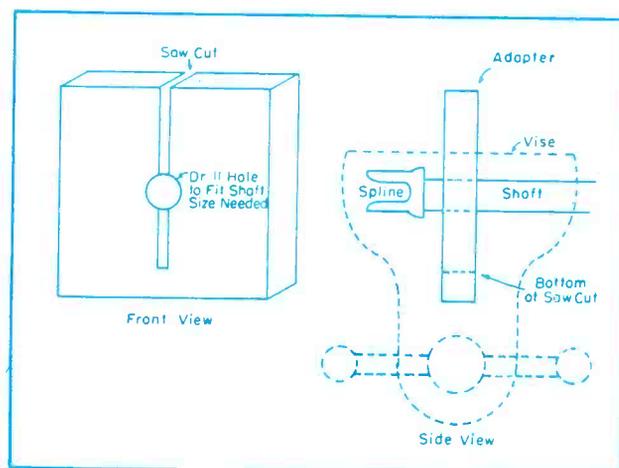
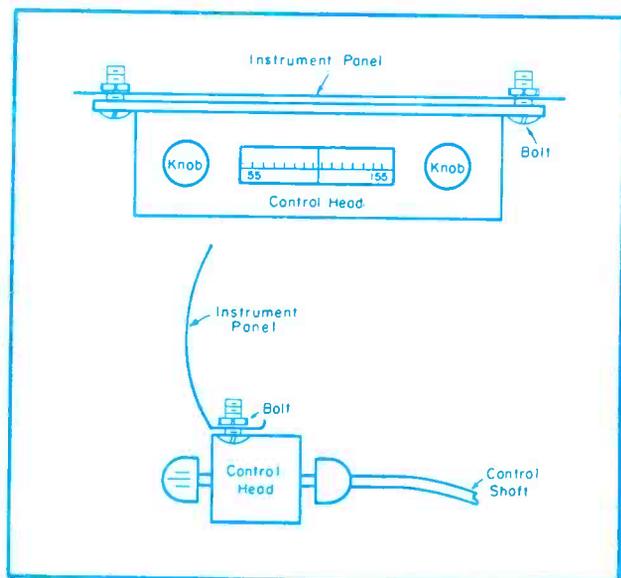


Fig. 1. Adapter for holding of flexible cables and shafts for the replacing of splines or fittings.

Left, Fig. 2. Remote-control head and shaft mount setup.

IN THE AUTO RADIO SYSTEM, remote-control heads are particularly important, serving as the key operating-control link involving tuning, volume control, switches, etc.

Mounted on the firewall, the remote control unit is connected to the radio chassis by a flexible cable, similar to the type used for the speedometer cables, but considerably better. Before the war, these cables, or *shafts*, were limited to about twenty-four inches in length, due to manufacturing difficulties. However, during the war, cables were developed for the control of aircraft radios, which ran up to thirty-five feet in length, without any slack or slipping. These principles have now been incorporated in the design of current model auto-radio tuning shafts and cables.

The cables are terminated in fittings known as *splines* which engage similarly shaped female sockets on the volume-control tuning device, etc. They are found in divers shapes, the most common being square, slotted, and tongued. Some of the older ones used a small pinion gear on the end of the shaft, which engaged a segment gear on the variable capacitor of the set. Some have used a multi-grooved spline which engaged a soft rubber socket, to drive bandswitches, etc.

While these shafts are flexible to a remarkable degree, there are definite

limits. The shafts must never be installed in such a way that they will bend over a radius of about ten inches. A shorter bend than this will cause them to bind and wear rapidly. It is always necessary to check control shafts for a freedom of movement after preliminary positioning, tying them in the position which gives the smoothest operation. They should be tied to braces, etc., with friction tape. Incidentally, they must not be tied to rods which must move, such as the choke or throttle rods on the '38-'39 Fords.

The control heads themselves are fundamentally the same. That is, they have a dial scale, with pointer, and two shafts for the volume control and tuning knobs. Some have tone controls or tone control switches on them, and some have push-button selector assemblies, for the automatic tuning sets. The dial pointer is usually driven by a linen cable, just as in the household sets. Some of the older ones used gears sometimes made of plastic. These didn't prove to be too practical, and accordingly the cable-drive is almost universal today.

A metal box is provided to form a mounting for these parts. Its shape is determined by its use. For instance, the *under-dash* or universal head will be found to be long and narrow, with brackets or ears to permit installation

under the lower edge of the dash. The *custom* heads have been designed to duplicate the original head made for that model car. These heads fit right into the space provided on the instrument panel, resulting in a custom-built type of job for any kind of receiver.

To install the *under-dash* control, it is necessary to select a location which is free from interference with other parts, such as the gearshift on the older cars, ventilator lift handles, etc. Also, it is important to see that the control shafts can reach to the set without too much stretching. In fact, the control shafts are the determining factor in the location. It's a good idea to slip them into the set, temporarily, and then select a location where they'll have the best run to the set. The head should be mounted to the underside of the dash with two small bolts, to fit the holes in the brackets or ears provided.

Some sets have the volume control itself in the head connected to the set with shielded cable. When installing this type, the paint must be scraped from under the mounting ears, to provide a good ground. Even then, it may be necessary to connect a heavy bonding braid from the set to the control head to cut down the hum.

When installing the cables, they must not be left in such a position that they can get into the cowl-ventilator

# Control Head and Shaft Installation and Servicing

by JACK DARR

Ouachita Radio Service

lift mechanism and be cut or bent. This is a warning which also holds true for speaker cables, automatic tuning cables, dial-light leads, etc. They must be tied out of the way with tape.

To install custom-built heads, it is first necessary to remove the cover plate over the opening in the dash. Then the head can be assembled as per the instructions supplied with each kit. Most of these heads are held in place by two nuts on the control shafts. Ordinarily a chromium-plated escutcheon is provided with the kits. This should be installed under these nuts. Then the plastic or metal cup washers, which cover the nuts, can be installed, followed by setting of the knobs. Some of these heads will require a back-brace, to hold the top of the unit into position. Their pilot lights are usually separate leads, and the pilot light itself is in a spring-collar socket, which snaps into place in the head.

Occasionally, the head, as furnished, doesn't quite fit the opening. This can be remedied by dressing down, with a small file, the rough places until the head can slip into place. The trouble is usually caused by grille roughness which occurs during the casting of the cover.

## Remote Control Shafts

The remote-control shafts may be repaired or altered without too much trouble, if certain precautions are observed. Fittings may be replaced or changed, and the length of shafts changed to fit your needs. It's always a good idea to keep a few standard fittings around, just in case!

The shafts are made up of two parts, the cable itself and an outer housing. The inner shaft, which does the work,

is made up of steel wires, *laid* or spirally wrapped around a core. There are at least two layers, wrapped in opposite directions, to give the shaft rigidity. These wrappings are under tension at all times, and therefore it is necessary to keep them in a secure position when working on them. An instant's carelessness will cause the outer layer to unwind, and the shaft will be ruined.

To replace or change a fitting, the shaft should be slid out of the housing as far as it will go. If it will come all the way, so much the better. The fitting should be held in a vise, and the shaft close to it cleaned. Grease, etc., should be washed out with carbon-tet, and then some solder sweated into the strands, close to the fitting. The solder should penetrate well into the cable, and be allowed to set. Then the shaft should be caught in the vise, if possible. If there isn't room, an *adapter* similar to the one shown in Fig. 1, can be used. This will provide a firm grip on the shaft. The shaft should be close to the fitting, gently twisting the fitting off the shaft, if it happens to be the swedged or pressed-on type. Often the shaft is soldered on. In this instance heat will permit one to pull it off. With soldered fittings, it is nec-

essary to see to it that the shaft is firmly held before attempting to unsolder. The strands of wire in the shaft will form *threads*, and the swedged fittings may be *unscrewed*. If the fitting is too tight to unscrew, it should be squeezed in the vise, several times, and then it will be found to loosen up.

The shafts may be cut easily, if the proper techniques are followed. First, the fitting should be removed, as explained, and the shaft pulled from the housing, marking the spot where the cut is to be made. Then the shaft should be cleaned and solder sweated into the strands for at least an inch on either side of the mark. Cutting can follow, using a hacksaw, or, still better, a small high-speed grinder can be used to grind the shaft down into two sections. A wheel with a square edge should be used, making the cut at an angle of about 30% with the edge. The shaft should not be allowed to get too hot while grinding, as it may melt the solder and let the shaft unwind. The end of the shaft should be left slightly rounded, and then finished smoothly, so that it can enter the fitting easily.

The housings may be cut in the same way, although the soldering is

(Continued on page 68)

**Design Features of Remote-Control Systems . . .  
How They Are Mounted . . . Custom-Type Head  
Characteristics . . . Shaft Construction . . . Repair-  
ing Shafts . . . Use of Adapter Mounts for Shafts  
During Servicing . . . Cutting Techniques.**

# PHONO *installation and service*

## Three-Way Speaker System Circuitry . . . Design and Application Features of Line Amplifiers, TV Audio Amplifiers, Tape Recorders, Paging, Ceiling, Wall and Auto Speakers, Turnover Cartridges and Radio-Phono Switches.

by **KENNETH STEWART**

THE TREND to the use of hi-fi amplifying systems has accented the possibilities of multiple-speaker hookups which might be used to provide wide-frequency coverage. Recently, a 3-way speaker arrangement was suggested, employing a tweeter, trumpet and a cone speaker, set up as illustrated below, at right.

With the cone (c) providing a 30 to 300-cps range, the trumpet (b) a 300 to 3000-cps coverage and the tweeter (a) 3,000 to 15,000-cps reproduction, the combination was described as an interesting approach to a broadband response affair.

As a housing a cabinet constructed of 3/4" plywood, approximately 30" x 40" x 16", was recommended. An opening or vent, 4" x 20", should be left at the top rear by means of a cutout in the back cover.

### Amplifiers

**Line Amplifier:** A plug-in line amplifier<sup>1</sup> with a self-contained power supply is now available for custom sound installations.

Amplifier can be used as a master mixer for up to four preamplifiers. It can also be used as a booster amplifier for supplying zero level to a telephone line, a line amplifier capable of operating from a telephone line, a driver amplifier supplying driving voltage for up to 500 power amplifiers<sup>2</sup>, a monitor amplifier supplying two watts of audio

power to a speaker, or a bridging amplifier for bridging a low impedance line. In addition, the amplifier can be used to supply plate and filament power to two preamplifiers<sup>3</sup> without affecting its primary function.

Amplifier features inverse feedback control and voltage-regulated power supply, and has a rated power output of up to two watts. An interstage gain control with positions 0 to 10 is mounted on the front apron of the chassis. Power supply consists of a

power transformer, high vacuum full-wave rectifier tube, and low hum output filter.

**TV Audio Amplifier:** A push-pull amplifying system<sup>4</sup> specially designed for television chassis has been developed. Tubes used include 2-6K6s or 2-6V6s, in push-pull and 1-6J5 driver. Power output is 6 to 8 watts. Chassis measures 3" x 5".

### Recorders

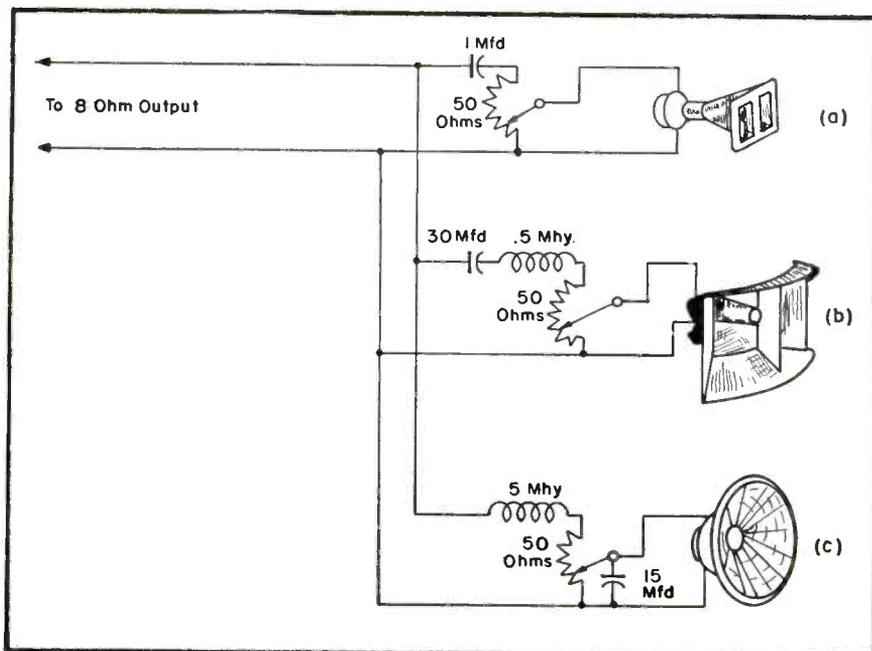
**Plastic-Tape Tape Recorder:** A tape recorder<sup>5</sup> with 625' of plastic tape, 7" takeup reel, microphone and built-in AM tuner, which can be used as a separate radio when not recording, has been announced.

Of dual-speed, dual-track design, recorders feature two hours of dual-track recording at 3.75 inches per second or one hour at 7.50 inches per second on a seven-inch reel of 1200' of plastic tape.

Six models are available; three with self-contained AM tuner built into the  
(Continued on page 28)

Three-way speaker system. C<sub>1</sub> is a 1-mfd paper, low voltage; C<sub>2</sub>, 30-mfd paper, low voltage; and C<sub>3</sub>, 15-mfd paper, low voltage. L<sub>1</sub> is approximately 0.5 milly with 175 turns of No. 16 dcc on a bobbin 1" i.d. x 1" long (flange o.d. 2 1/4"). L<sub>2</sub> is approximately 5.0 milly with 550 turns of No. 16 dcc on a bobbin 1" i.d. x 2" long (flange diameter 4"). Potentiometers are 50-ohm types, wire wound, with a 5-watt minimum capacity.

(Courtesy University Loudspeakers)



<sup>1</sup>RCA type MI-12160.

<sup>2</sup>RCA MI-12188.

<sup>3</sup>RCA MI-12241.

<sup>4</sup>Model 10MT; N. J. R. Electronics Company, distributed by Milo Sound, 200 Greenwich Street, New York 7, N. Y.

<sup>5</sup>Masco D37R

Why there's big profits ahead for Webster-Chicago dealers!

**12 million<sup>†</sup>**  
**RECORD CHANGERS**  
**need replacement**

**AMERICA'S FINEST!**  
**SENSATIONAL NEW**  
**Webster-Chicago**  
**Diskchanger\***



Balanced Tone Arm  
 Gives perfect record  
 touch on all size and  
 all speed records.



Velocity Trip  
 New mechanism gives  
 all records increased  
 quality playing life.



Cushion-Drop  
 New spindle  
 gently lowers records;  
 heavy flock turntable  
 cushions drop.



**Easiest to sell because it has  
 every wanted feature!**

Webster-Chicago dealers are cashing in on this huge conversion market because they sell Webster-Chicago Diskchangers—the only replacement changer with *all* these features:

- Automatically plays 12-inch, 10-inch or 7-inch records at 33 $\frac{1}{3}$ , 45 or 78 rpm without any special adjustments.
- Pick-up arm comes to rest position after last record is played.
- Idler wheel retracts when control speed is off; eliminates flat spot which causes "wow."
- Fewer working parts for longer life of carefree operation.
- New automatic manual position plays home recordings or "inside-out" records without special adjustment.

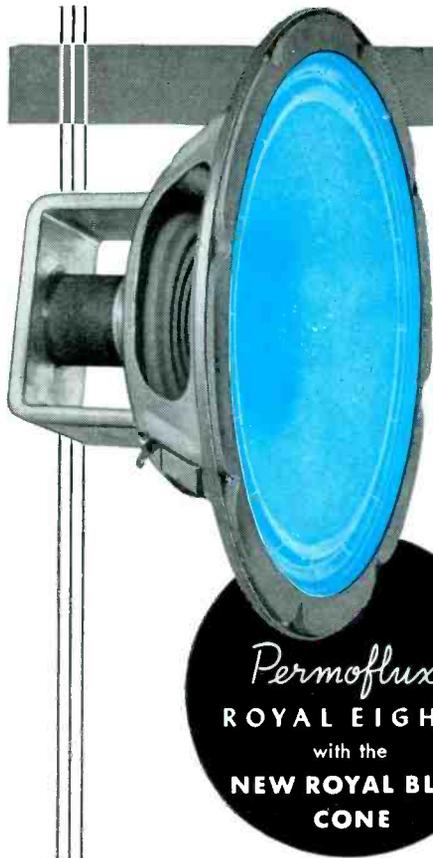
Webster-Chicago dealers know fast sellers like this Diskchanger mean bigger profits... that's why they're stocking up now for the big fall-winter selling season!

<sup>†</sup> Radio and Television Retailing—May

\*T. M. Reg.

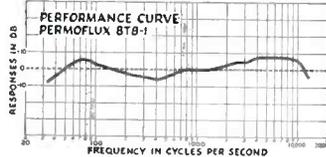
Another  Product

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new

*Permoflux*  
**ROYAL EIGHT™**  
**compares with**  
**any 12" speaker!**



This averaged laboratory response curve of the Permoflux 8T8-1 proves that it compares with the finest speakers regardless of size or price.

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**NEW ROYAL BLUE**  
**CONE**

**It's Your "Springboard" to Extra Sales with Customers who want 12" performance but don't want to pay a 40% higher price.**

From the resonant boom of jungle drums to the light warble of the flute, this new 8" speaker reproduces sound with superior sensitivity and fidelity. The tonal qualities of this magnificent speaker can only add to the excellence of any audio equipment.

Special processing provides extra-strong cone; allows cone to be soft-suspended from basket and held at coil-end by extra-large spider. Permits more faithful reproduction at lower frequencies. Deeper, curvilinear cone greatly extends high-frequency response.

Permoflux Royal Eight" (Model 8T8-1) is ruggedly-built, and simple to install. Provides big speaker performance in a small frame—uses smaller, more economical baffle. List Price \$15.00.

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**PERMOFLUX CORPORATION**  
 4900 W. GRAND AVE., CHICAGO 39, ILL. • 236 S. VERDUGO RD., GLENDALE 5, CALIF.

**Phono**

(Continued from page 26)

mechanism housing. Two of the models are complete with tweed and fabricoid carrying case with leather handle and two others have a self-contained, hook-hinged, metal cover with lock and key and with a spring handle.

All models have threaded (6-32) supply and takeup reel spindles which permit bolting down of reels and allow playing the recorders in any position.

Power output, 5 watts.

**Tape Recorder:** A tape machine<sup>6</sup> which can record at both 3¾ and 7½ inches per second, is now available. According to the manufacturer, this feature means that spools recorded on it can be interchanged with other tape recorders. The machine uses a double-track tape providing two hours of recording at the slow speed without turning over the reel. Recorder has fast forward and fast reverse speeds. At the fast speed, a 1,200-foot reel of tape will run through in three minutes.

The recorder is also said to feature a new development in tape reels; loop



Masco tape recorder.

leaders that simply drop over the reel. With these, the machine operates to the end of the reel and then stops automatically without any danger of the leader slipping from its moorings.

Uses five tubes and a rectifier in a straight ac circuit. Three of these are dual-purpose tubes. A six-inch speaker is supplied.

Standard equipment includes a microphone, power cord, an empty reel and one spool of tape measuring 1,200 feet.

**Speakers**

**Paging Speaker:** A paging type speaker<sup>7</sup> with a power input capacity of 12 watts continuous, and a frequency response of 250-10,000 cps, has been developed. Said to be capable of wide angle dispersion of sound in the horizontal plane, while limiting the vertical dispersion to the optimum degree for paging and talk-back purposes.

Speaker is said to incorporate the advantages of the *University* reflex formula plus the superiority of a *cobra*-shaped horn. Features a hermetically-sealed integral driver unit design.

**Flush Mounting Grille:** A 10-inch steel disc<sup>8</sup> for speaker flush mounting in walls or ceiling is now available.

<sup>6</sup>Web-Corp.; Webster-Chicago Corp.

<sup>7</sup>Cobra 12; University Loudspeakers, Inc.

<sup>8</sup>Model 10-P; Wright, Inc. <sup>9</sup>Wright NP-7316.

<sup>10</sup>Wright NP-832 and NP-8680. <sup>11</sup>Wright 10-P.

<sup>12</sup>Model 96-T; Electro-Voice.

Webster-Chicago tape recorder.





University Loudspeaker paging speaker

Supplied in two finishes; polished chrome plate or with a baked on prime coat.

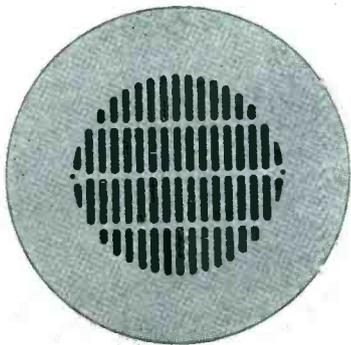
Grilles can be equipped with 7-inch pm speaker<sup>8</sup>, as well as 8-inch types<sup>10</sup>. Grille can also be used as a back-seat automobile speaker<sup>11</sup>.

**Pickup Cartridges**

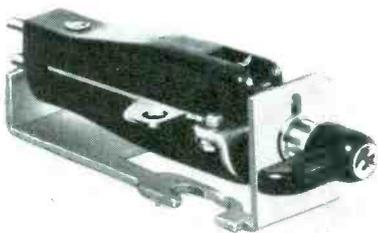
**Torque Drive Turnover Cartridge:**

A turnover type crystal cartridge<sup>12</sup> for record players has been developed.

In the cartridge, each needle is completely isolated. There is said to be no (Continued on page 70)



Wright flush-mounting grille.



Electro-Voice torque-drive pickup turnover cartridge.

Automatic phono changer with the *Tri-O-Matic* changer spindle developed by the V-M Corp., on which a patent (2523045) was recently issued.



# PREMIUM QUALITY at NO EXTRA COST

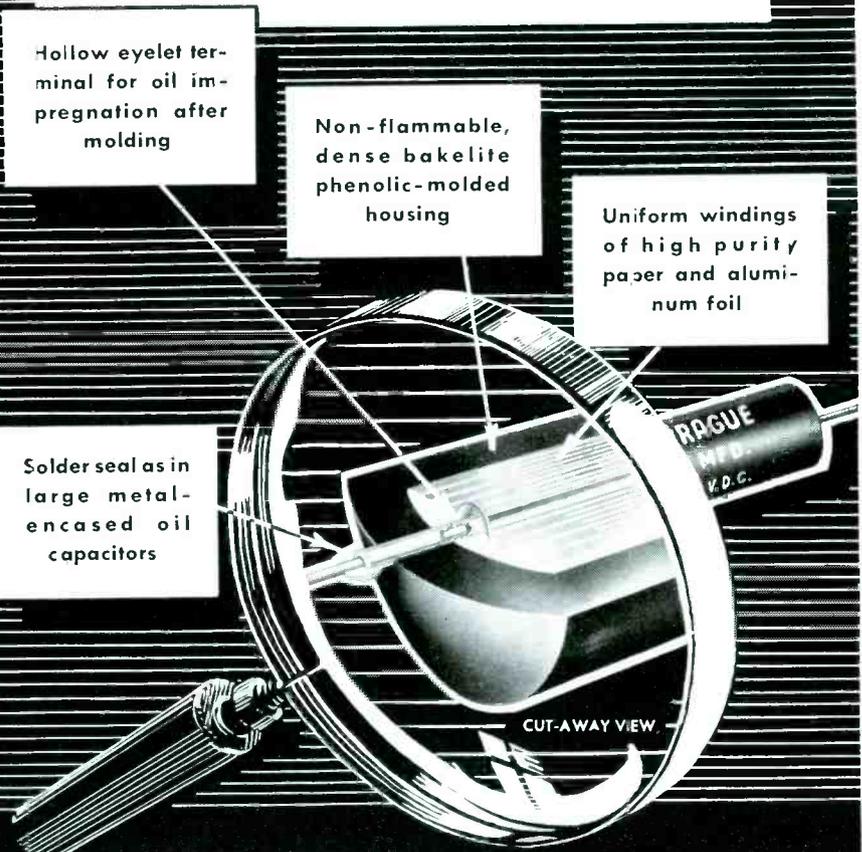
Sprague Telecap<sup>★</sup> Tubulars are superior to every other molded paper capacitor because they are made by the same dry assembly process as large metal-encased oil capacitors. They *cannot* be contaminated by dust or moisture during manufacture.

Every Sprague Telecap, from 600 to 12,500 volts, is molded *dry* . . . then mineral-oil impregnated under high vacuum through a small opening . . . and the terminal solder-sealed after the lead is inserted.

Result? Top resistance to heat and moisture . . . extra high insulation resistance . . . superior capacitance stability . . . and a capacitor that is preferred by the nation's leading television manufacturers.

Ask for Telecaps at your jobber's. Or write for bulletin covering details and specifications.

## TELECAP<sup>★</sup> TUBULARS



Hollow eyelet terminal for oil impregnation after molding

Non-flammable, dense bakelite phenolic-molded housing

Uniform windings of high purity paper and aluminum foil

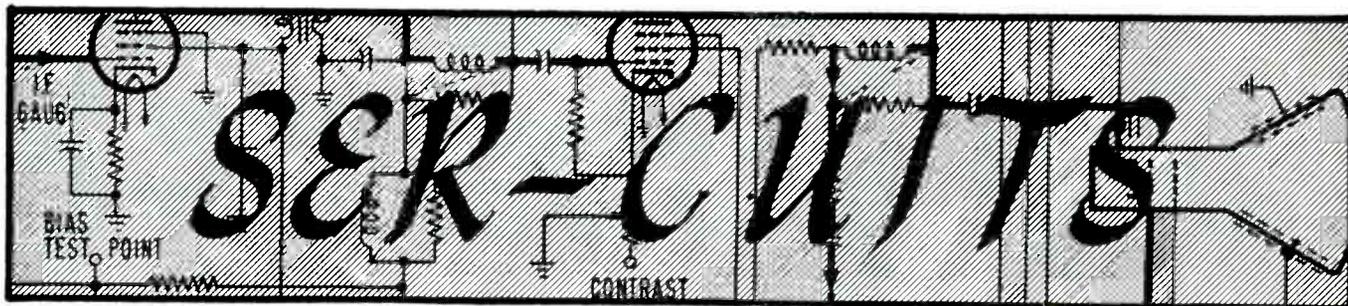
Solder seal as in large metal-encased oil capacitors

CUT-AWAY VIEW

**SPRAGUE** SPRAGUE PRODUCTS COMPANY  
North Adams Mass.

PIONEERS IN ELECTRIC AND ELECTRONIC DEVELOPMENT

★Trade Mark



## Circuitry Highlights of Narrow-Neck Picture-Tube Models Which Feature New Type Deflection Systems.

THE RECENT DEVELOPMENT of a narrow-neck type of picture tube, which permitted the use of new types of deflection systems, has introduced several interesting TV circuitry innovations. In view of the tube's design, featuring a flaring of the tube where the neck joins the funnel, it has been found possible to distribute the windings of the horizontal yoke in order to place the field in proportion to the amount of deflection necessary at each particular point. As a result, the power requirements of deflection could be reduced substantially.

### Selenium Rectifiers Used

The reduced power requirements of the deflection system permitted the application of a selenium rectifier operating directly off the line. The use

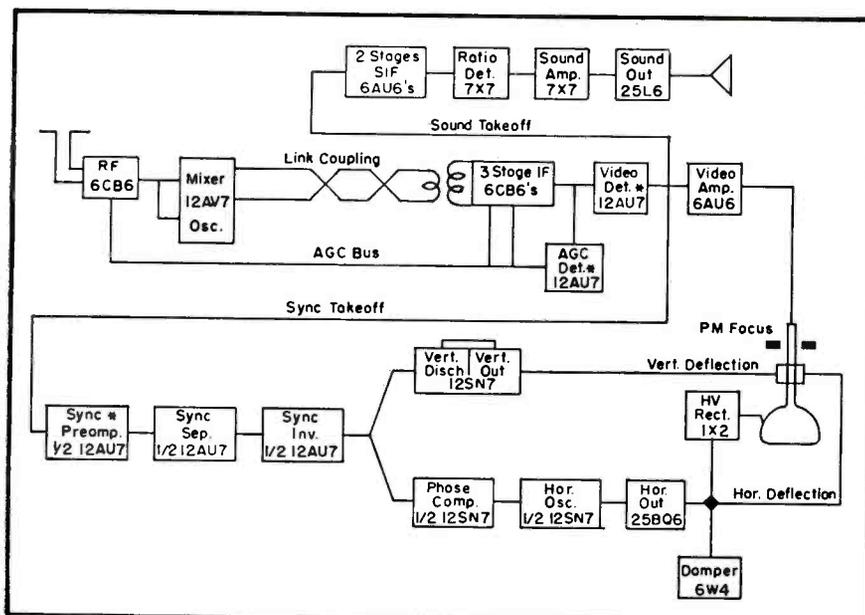
of a power transformer was found to be unnecessary, because high *B* voltages were not required. However, in order to achieve a *B* supply higher than that available from the line alone, the filament transformer was so connected that the 6.3-volt secondary could operate series aiding, and thus the *ac* voltage applied to the selenium rectifier became 6.3 volts more than the line voltage. In addition, the plate returns of the vertical oscillator and output stages, and the horizontal oscillator and output stages were returned to a point on the horizontal damper stage to take advantage of a *boost* voltage contributed by the damper action: the voltage at this point is over a hundred volts higher than the *B* voltage. The damper stage actually has two functions. First, as its normal deflection and permit fast retrace ac-

tion; and, secondly, acting somewhat like a voltage doubler stage, to assist the power supply, creating a higher *B* voltage for the deflection system.

### Chassis Features

In Fig. 1 appears a block diagram of one series of models using the narrow-neck type tube; Philco 51-PT1207, 51-PT1208, 51-PT1234 and 51-PT1282. The chassis features a tapered line tuner which is link coupled to the first *if* stage to permit the use of a low-impedance circuit and thus reduce the possibility of extraneous pickup in the length of wire between the tuner and the first *if* stage. Three stages of *if* are equipped with high-gain 6CB6s. One half of a 12AU7 is connected as a double diode, serving as the video detector and an *agc* diode. A single stage of video amplification (6AU6) supplies drive to the cathode of the picture tube. Incidentally, according to the manufacturer, the average sensitivity is in the order of 75 microvolts.

Fig. 1. Block diagram of Philco chassis using narrow-neck picture tubes.



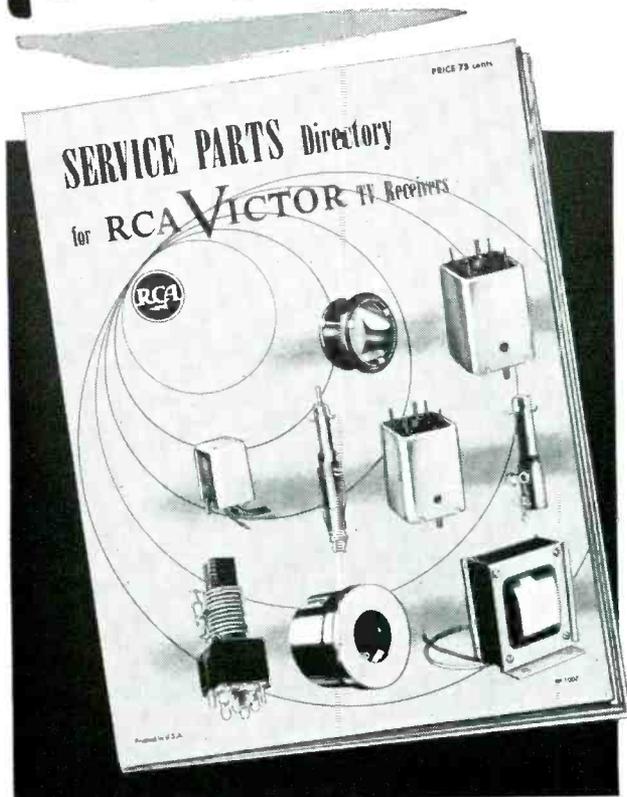
### Intercarrier Sound Used

The sets use intercarrier sound, with a take-off point at the second detector. While the practice of using the video amp as a takeoff point does take advantage of the video amplifier's gain, perhaps permitting one less stage of *aif*, it has been found that this arrangement is often not best for buzz-free performance. Should noise or sync pulses overdrive the video stage, it could cause an interruption of the sound signal and thus introduce buzz. Two 6AU6s are employed as sound *if*, driving a conventional ratio detector (7X7). The triode section of the

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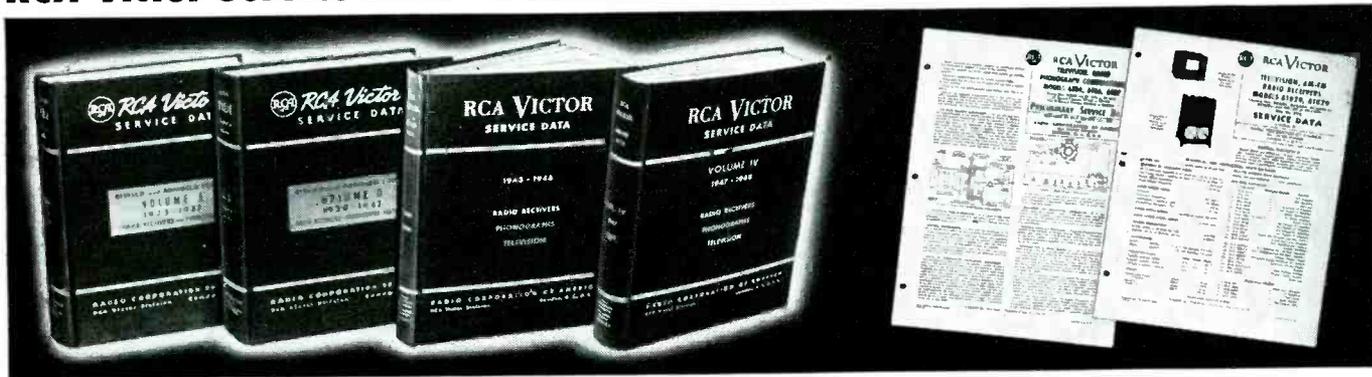
## on RCA VICTOR television receivers



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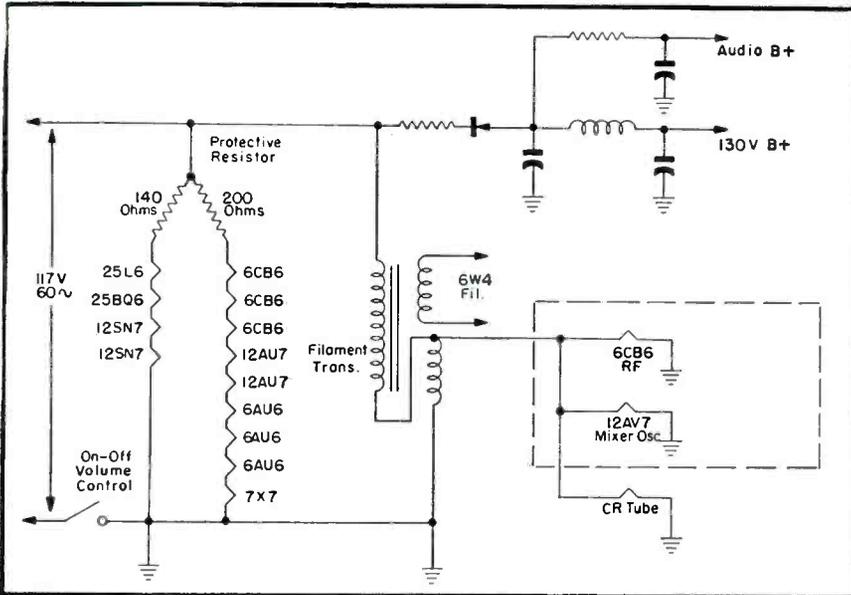


Fig. 2. Power and filament supply of Philco TV models

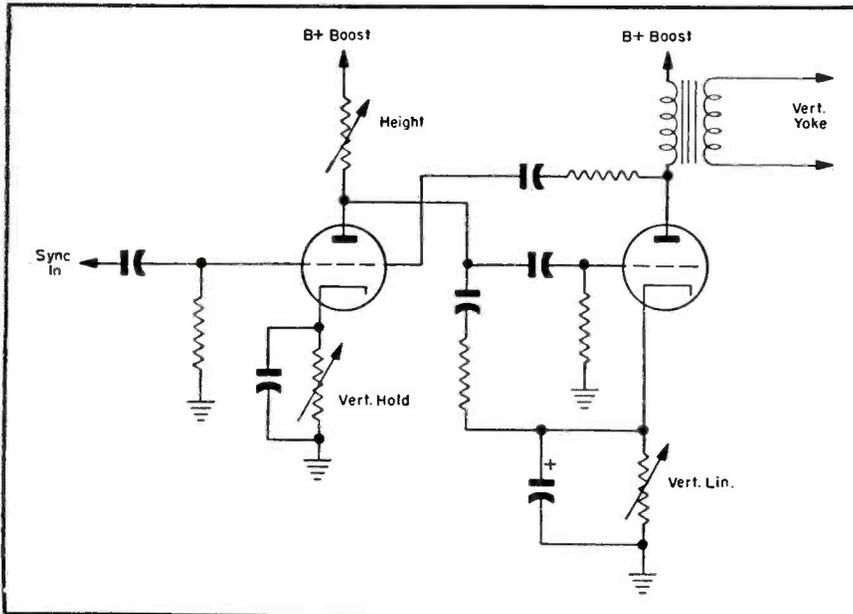
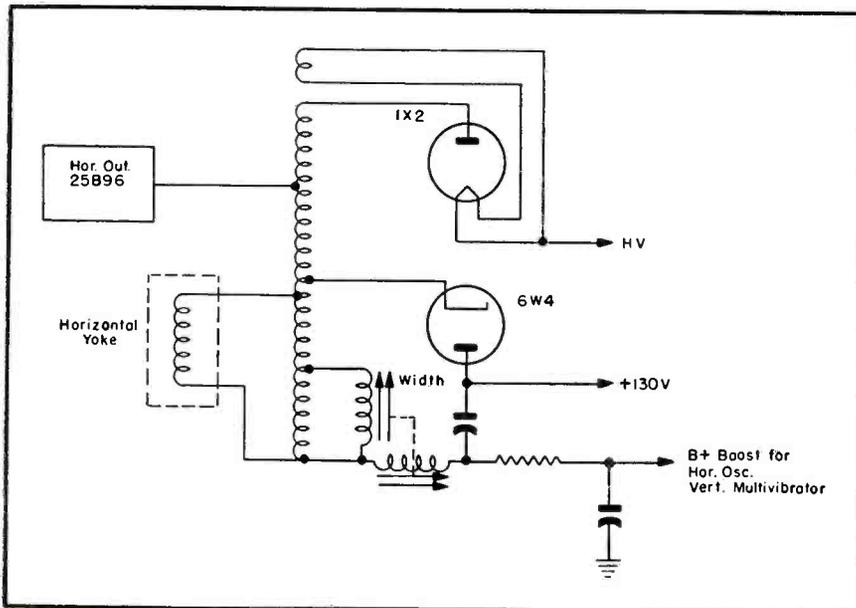


Fig. 3. The vertical sweep section of the Philco TV receivers.



7X7 is used as an audio amplifier driving a 25L6 audio output stage.

The sync take-off is also at the second detector where it can be free from the effects of the contrast control.

The savings in vertical deflection power made possible by the narrow-neck picture tube permits the use of a single section of a 12SN7 as a vertical output stage. This, in conjunction with the vertical discharge tube, together form a vertical multi-vibrator circuit.

### Horizontal Sync

Horizontal sync is obtained by the *afc* phase comparator circuit used previously within the Philco 1400 series. The horizontal output stage is a 25BQ6 damped by a 6W4.

A single 1X2 high voltage rectifier is used, but the reduced power requirements of horizontal deflection, permits the use of a new type of horizontal output transformer which delivers more than 10 kv for anode supply voltage.

### Focusing Provision

Focusing in these models is obtained by adjusting a steel ring within the field of fixed permanent magnets.

In Fig. 2 appears a schematic of the power and filament supply. The two filament strings are protected from high current surges by protective resistors, in series with each string. When the receiver is first turned on, the filament resistances are low. This normally permits a serious surge of current that has reduced the life expectancy of tubes in series strings. However, the introduction of the protective resistor limits the current and the voltage drop across the resistor reduces the voltage across the filaments. This system has been found to increase the life expectancy of series strings to that of the same tubes used with a filament transformer.

### Vertical Sweep

The vertical sweep section is shown in Fig. 3. Because of the low-deflection power requirements, it is only necessary to use one half of a 12SN7 as a vertical output stage and the other half is used as a vertical discharge tube. The combination of the two stages

Fig. 4. Horizontal output transformer used in the Philco narrow-neck models.

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August 21, 1950

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16RP4 Rectangular



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operate as a multivibrator. The horizontal output transformer is illustrated in Fig. 4. The transformer is an autotransformer type for both the high voltage and the sweep, and the core of the transformer is a single straight cylindrical core instead of the conventional *C* or *E* shaped cores. The straight cylindrical core is described as having a much greater air gap permitting more of the energy to be utilized for high voltage.

The 6W4 is used as the damper stage but it also has one other function, as stated previously. The damper pulse is utilized as a source of *boost* voltage, charging the capacitor in the plate circuit of the damper stage. About 120 volts appear across the capacitor and is in series with the *B+* 130. The combination combines and is used as a 250-volt source for the horizontal oscillator and vertical deflection circuits.

#### Focusing\*

In the early days of TV, both the electrostatic and electromagnetic types of picture tubes were used. On occasion the Service Man has been confronted with the electrostatic models and there has been some confusion because of the tube design variations.

When electromagnetic focusing is used, the electrostatic forces considered in connection with electrostatic focusing are replaced by magnetic forces set up by a focus coil which is placed around the neck of the tube. The focus coil is usually wound in the form of a ring, with many turns of fine wire. Direct current is passed through the focusing coil to produce the desired magnetic field and the amount of current through the coil is varied to provide for fine focusing.



Hoffman silver-circle tuner utilizing printed circuits. Features continuous tuning via a tuning shaft mounted on roller bearings. On the shaft are eight shorting bars that vary the inductance on a printed circuit. There are also eight printed circuits, each photo-etched with silver on insulating material. Tuner has sixteen moving parts that wear eight sliding silver contacts and eight heavy silver tuning lines; eight solid bearings on shaft with one planetary drive and eight bearing surfaces.

Currently the focus coil makes use of both permanent and electromagnetic fields. Instead of using a larger coil with thousands of turns of wire, a much smaller coil is used in conjunction with a circular permanent magnet. The coil is placed inside the circular permanent magnet which supplies the major portion of the magnetic field. The coil itself supplies the remaining portion of the magnetic field necessary for focusing, the current through it being variable so as to provide fine focusing.

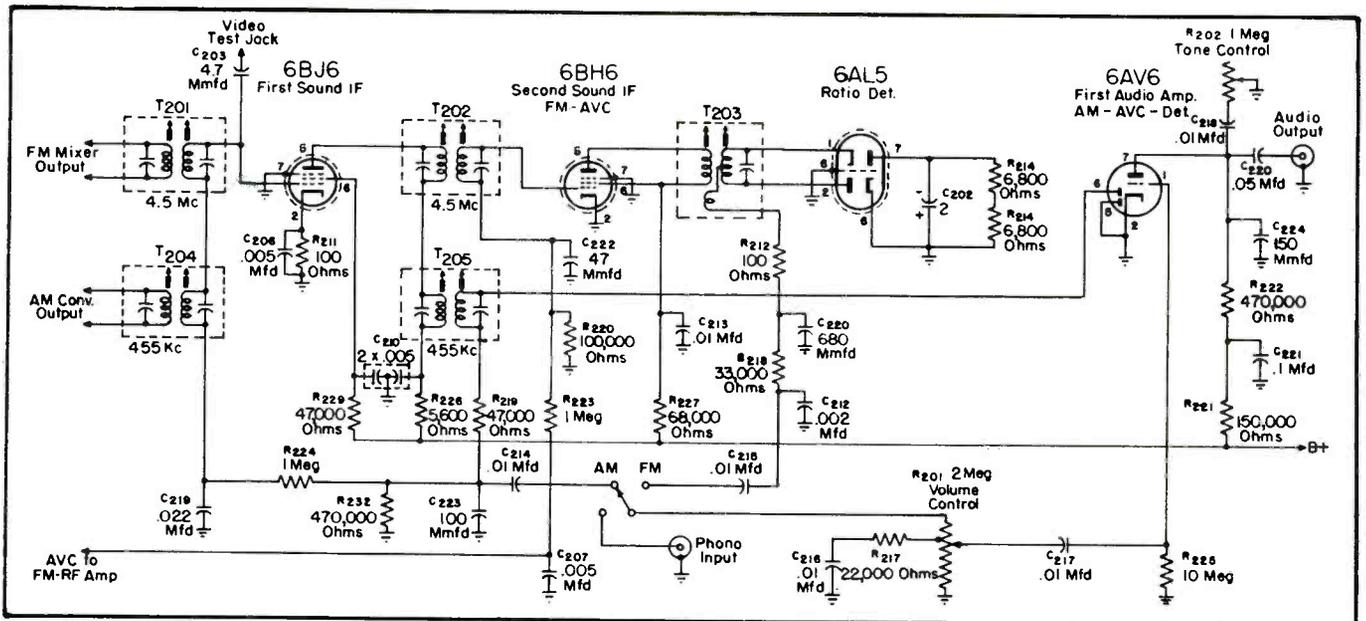
This type of focus coil provides two advantages over the usual type of coil where all the magnetic field is due entirely to the coil itself. First, it minimizes defocusing of the beam due

to line voltage fluctuations since most of the magnetic field is fixed due to the permanent magnet ring. Also, since only a small portion of the total magnetic field necessary for focusing is produced by the coil itself, the energy supplied by the power supply for focusing is held to a minimum.

#### Electromagnetic Deflection

With electromagnetic deflection, coils are used instead of plates and they are placed around the outside of the tube neck. By passage of a suitable current waveform through these coils, a scanner raster can be produced on the screen of the picture tube, just as in the case of the electrostatic type of tube. The strength of the magnetic field produced by these coils is proportional to the current through them and the instantaneous deflection of the beam is proportional to the instantaneous current through the coil. To deflect the beam at a uniform rate, the current through deflection coils must change at a uniform rate. To accomplish this, a sawtooth waveform of the current is passed through the coils, which compares to the sawtooth voltage waveform required at the deflecting plates for electrostatic deflection. It should be remembered that when electromagnetic deflection is employed a current of sawtooth waveform is used, while for electrostatic deflection a voltage of a sawtooth waveform is used.

To produce a rectangular raster, it is necessary for both the horizontal and vertical deflecting forces to operate simultaneously at right angles to each other, as in the case of electro-



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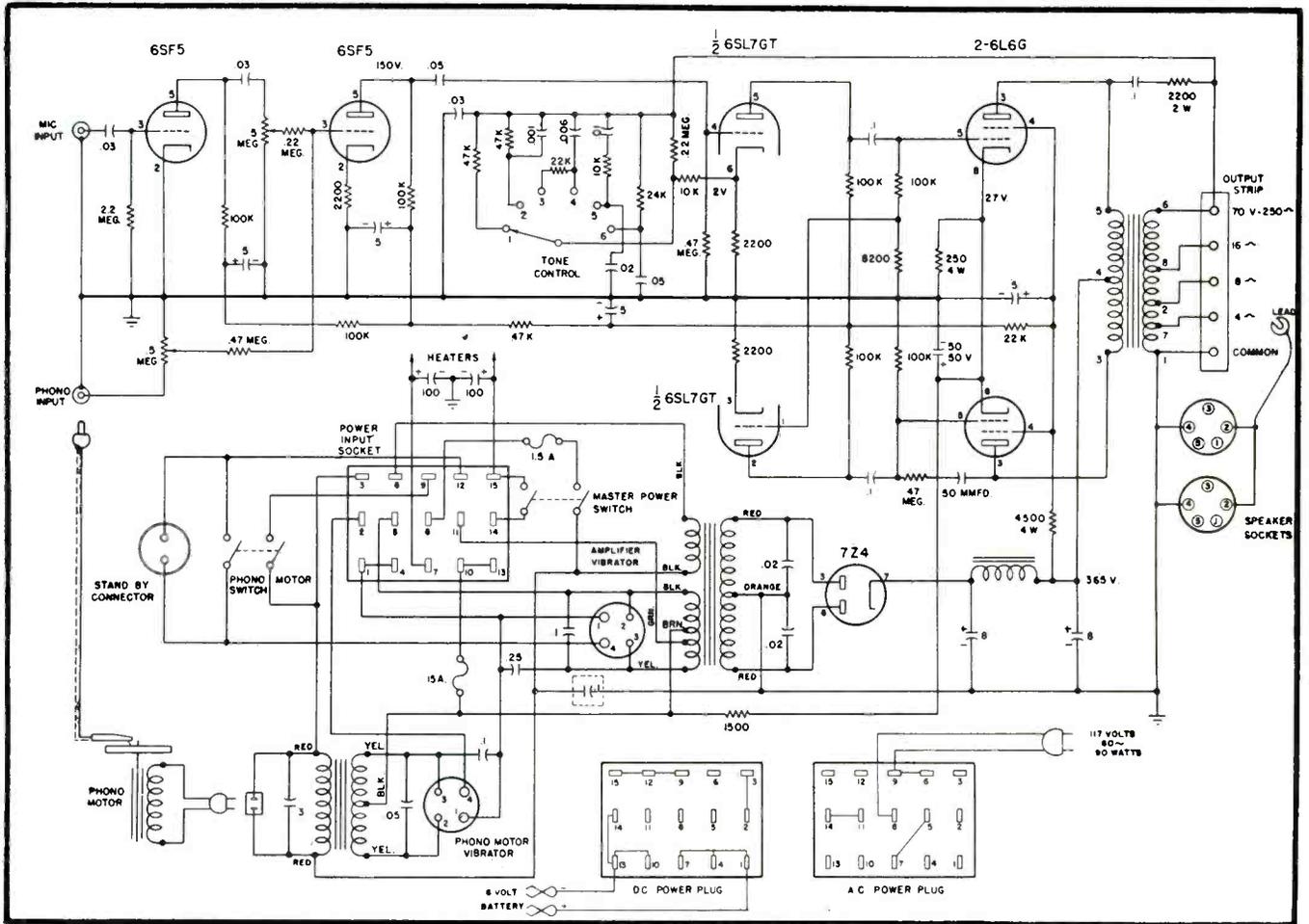
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static deflection. To accomplish this, two sets of coils are used which are placed around the tube neck at right angles to each other. For horizontal deflection a coil is placed above the neck of the tube and one directly below the neck of the tube with the two coils connected in series. For vertical deflection, a coil is placed on either side of the tube neck with the two coils connected in series. Each set or pair of coils connect to its own output transformer which matches the low impedance of the coils to the plate impedance of the sweep output tubes. An important point to note is that the magnetic field produced by the vertical set of coils is exactly at right angles to that produced by the horizontal set of coils.

#### Horizontal Deflection

For horizontal deflection the coils are placed in a vertical plane, while for vertical deflection the coils are placed in a horizontal plane. Both pair of coils properly mounted at right angles to each other are combined in one assembly which slips over the

neck of the tube and is referred to as a deflection yoke. The deflection yoke is always placed on the neck of the tube so that the end nearest the screen presses against the bell of the tube.

#### Electromagnetic Fields of Force

The reason for this arrangement of the deflection coils is that the electromagnetic fields of force set up by the coils, deflect the electron beam in a direction which is at right angles to both the direction of the original line of motion of the electron beam when entering the magnetic field. The deflection of a beam of electrons by means of a magnetic field may be explained by the well-known rule of motor theory, where a wire carrying a current in a magnetic field experiences a force perpendicular to the direction of the electron flow in the wire and the direction of the field acting upon the wire.

#### Electromagnetic Tube Voltage Circuits

In the basic voltage circuit for a typical electromagnetic type of pic-

ture tube the high voltage is normally connected to the aquadag coating, which in this case acts as the second or high voltage anode. However, in some picture tubes a metallic second anode is used and the aquadag coating merely makes electrical contacts with it. The high voltage supply may vary from approximately 2000 to 30,000 volts, depending on the particular type of tube used. The first anode is operated at a much lower voltage than the second anode. A potentiometer is provided to vary the bias between the control grid and cathode which controls the intensity of the electron beam and, therefore, the brightness of the picture. The focus coil is connected to a dc source through a potentiometer so that the current through the coil can be adjusted for proper focusing of the beam. The video signal is introduced into the grid-cathode circuit of the tube.

\*From TV lecture data prepared by F. Fowler and H. Lippert of the G. E. technical service section.

# Jensen NEEDLES

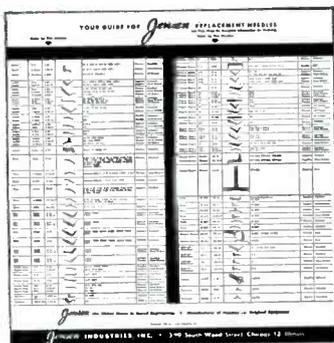
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# Serviceing Helps

by M. A. MARWELL

CHRISTMAS TREE effects which often occur during between-channel tuning or tuning to one particular channel can be eliminated in the Hoffman 170 series chassis by reducing the resistance value of  $R_{157}$ , the 220,000-ohm resistor, that is in series with the horizontal-drive potentiometer, to 150,000 ohms.

This change has been made on all sets produced after serial No. G067626.

## Elimination of Smear

Smear, as exemplified on the screen by trailing shades from black toward white after large dark objects and white toward black after large white objects, and a general fuzzy appearance throughout the picture, has been found to appear in some sets. In some chassis it may be caused by an insufficient low-frequency response of the video amplifier, and it can be eliminated by an increase in low frequency response. To accomplish this in the Hoffman chassis (170 series) the coupling capacitor ( $C_{145}$ ) between the video amplifier and the picture tube should be increased from .005 mfd, 500  $v$  to .22 mfd, 200  $v$ .

This change has been made on all sets produced after serial No. G067626.

## Contrast Improvement

Field reports have indicated that more picture contrast on Hoffman

chassis is desirable at the high level settings of the contrast control. The condition shows up as a washed out appearance of the picture. The effect has been due to the linear relationship between increase in contrast and increase in brightness. To obtain a picture that appears to have more contrast at high contrast levels, the relationship can be made non-linear by increasing the value of  $R_{161}$  from 100,000 ohms to 330,000 ohms. When this has been done, it will be found that the picture brightness will increase at a slower rate than the rate of increase in picture contrast.

This change has been made on all sets produced after serial No. G067626.

## Replacing Picture Tubes

Due to the difference in manufacturing tolerance between various brands of picture tubes, it may be found that replacing one brand with another will result in too much brightness, even with the brightness control turned fully off.

This may be corrected in the Admiral 20V1 chassis by connecting a 470,000-ohm,  $\frac{1}{2}$ -watt resistor (part number 60B8-474) across the 1-mfd capacitor,  $C_{308}$ .

The resistor places a negative bias on the video amplifier tube,  $V_{305}$ , and decreases the current through this tube. By connecting the resistor across  $C_{308}$  instead of between the grid of the

video amplifier and ground, the  $dc$  reinsertion is also improved.

The 470,000-ohm resistor is included in current production 20V1 chassis, commencing with run 3, code *OP*. (All 20T1 chassis will have this resistor.)

## Audio Hum

A strong 60-cycle hum in any of the Admiral 24D1, 24E1, 24F1, 24G1 and 24H1 24-tube chassis might be caused by one of the three following conditions.

(1) The volume control lead may be connected to the grounded heater lug of the first audio tube instead of to the grounded *cathode* lug.

(2) The  $ac$  power leads to the switch on the volume control may run too close to the first audio grid circuit. The leads should be dressed to keep them away from this critical circuit. Late production sets use a retaining lug on the chassis to keep these  $ac$  leads dressed.

(3) The coupling capacitor between the volume control and the first audio grid may be reversed. For minimum hum pickup, the outside foil must be connected to the volume control.

## Vertical White Bars at Left of Picture

Vertical bars in the Admiral 24-tube chassis may be reduced to a minimum by inserting a filter circuit between the horizontal output transformer and the yoke. The filter consists of the following parts wired in parallel: Width coil, part number 94A4, used in 30 series chassis; .01-mfd 600-volt capacitor, part number 64B5-10; and 470 ohm, 1-watt resistor, part number 60B14-471.

The filter should be connected in series with the lead between terminal 4 on the horizontal output transformer and pin 5 of the damper tube,  $V_{405}$ .

The coil slug should be adjusted until the white vertical bars are reduced to a minimum. In some instances, leaving the 470-ohm resistor off may provide a greater reduction.

This trouble should not be confused

---

**Eliminating Christmas Tree Effects and Smear and Improving Contrast in Hoffman TV Chassis . . . Replacing Picture Tubes, Removing Hum and Sync Buzz, Eliminating Vertical White Bars at Left of Picture, and Substituting Tubes in Admiral TV Sets . . . Low-Capacity Probe Modification to Afford 'Scope Calibration . . . Factors Affecting Radiation in TV Sets.**

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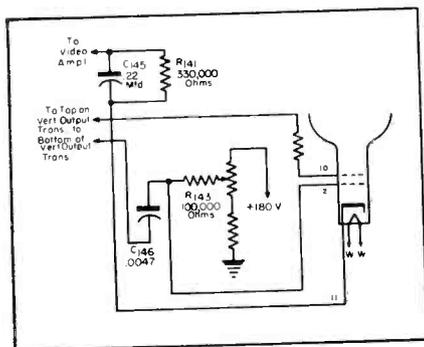


Fig. 1. Hoffman TV chassis revisions to eliminate smear and provide contrast improvement.

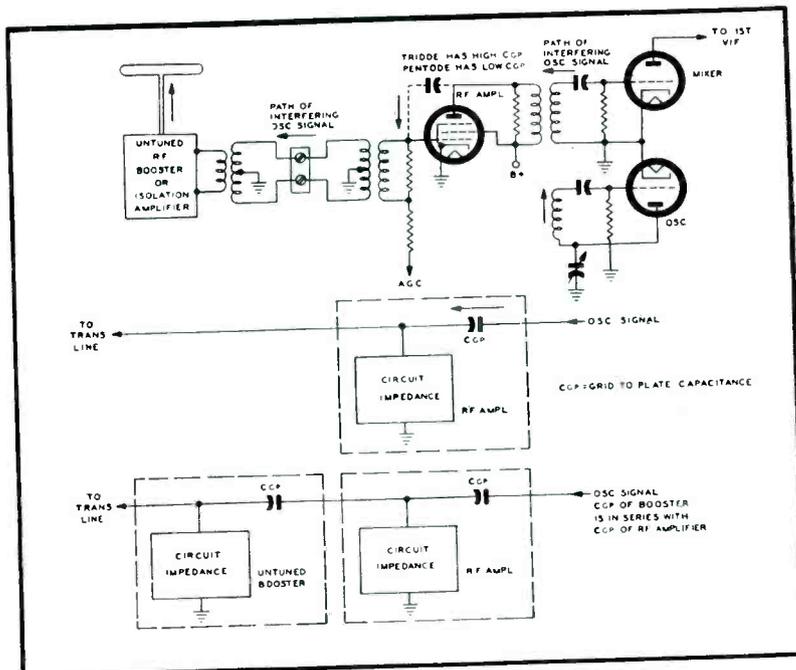


Fig. 2. Diagram showing path of interfering oscillator signal through an rf amplifier stage.

with vertical lines produced by misadjustment of the horizontal drive.

#### Sync Buzz

A small number of Admiral 21B1, 21C1, 21D1, 21E1, 21H1 and 21J1 chassis (approximately 200) were produced, using a 50-mmfd capacitor in place of 500-mmfd, shown as C<sub>205</sub> on the schematic. This may cause sync buzz when receiving certain stations and the small capacitor should be replaced with a 500-mmfd unit.

#### Admiral 21B1, 21C1, 21D1, 21E1, 21H1 and 21J1: Insufficient Picture Width

If it is not possible to obtain sufficient width by replacing tubes in the horizontal sweep and B+ circuits, capacitor C<sub>435</sub> (.0022 mfd) should be replaced with a .0047-mfd, 600-volt (part number 64B8-15) unit. The larger capacitor will reduce the picture tube second anode voltage, but the decrease in brightness will not be noticeable.

#### Tube Substitutions

A 6AG5 may be used in place of the 6AU6 (V<sub>303</sub>) third-video if tube, if a 6AU6 is not available for replacement; 6AG5 tubes should not be used for the first and second video if amplifiers.

To permit this substitution, the ground lead between pin 2 and the center socket shield on the third video if tube socket should be clipped. An 18,000-ohm, 1/2-watt resistor (part number 60B8-183) should be connected between pin 1 and ground, making the leads as short as possible. Then a tube shield base (part number

87A7-6) should be soldered over the top of the tube socket. The 6AG5 can be inserted in the socket and a tube shield (part number 87A7-7) placed over the tube. The if alignment should be checked and any necessary adjustments made.

Due to the scarcity of certain types of tubes, some Admiral chassis may be found to have tubes of a different type to that shown on the schematic.

In the 21 series TV chassis, the vertical output tube type 6S4 has been changed to a 6SN7GT. In the 21 series TV chassis, and in the 20T1, 20V1 chassis, the 6AV6 sound amplifier has been changed to a 6SQ7.

In TV only sets using the 21 series chassis, and in the 20T1, 20V1 chassis, the sync-separator and clipper-tube, type 12AU7, has been changed to a 6SN7GT. Also in the 21 series chassis, the 6AU6 video if amplifier tubes have been replaced by 6AG5s. The two tube types are not directly interchangeable, due to the different socket wiring; thus the type number stamped on chassis should be noted before replacing. The 6AL5 sync discriminator in the 21 series chassis has also been changed to a 6H6.

#### Low-Capacity Probe

The Emerson low capacity probe described in this section in the September issue is not adaptable for use with different 'scopes since it cannot be calibrated. To revise, the fixed capacitor, C<sub>1</sub>, should be changed to a trimmer variable from 4 to 30 mmfd.

\*From copyrighted service notes, prepared by Philco.  
<sup>1</sup>Kamen, Ira; TVI, SERVICE; August and September, 1950.

The value of R<sub>1</sub> must also be changed from 1.2 to 1.5 megohms, ±5%. The probe can be calibrated by first connecting the probe to the output of the video detector (across detector load resistor). Then, with the 'scope sweep set at 30 cps, C<sub>1</sub> should be adjusted so that the vertical blanking pulses and the horizontal blanking pulses line up. The probe can then be considered as calibrated for the particular 'scope in use and should not be readjusted unless the 'scope is changed.

#### Factors Affecting Amount of Radiation\*

In most cases, local-oscillator radiation takes place from the antenna of an offending receiver, and, to some extent, from the transmission line. If the line is mismatched, with a correspondingly high standing-wave ratio, the chances for line radiation are increased. Occasionally coax cable, when used as the transmission line, will reduce line radiation, but it has been found to be good practice to separate the lines of the different receivers as much as possible.

Radiation is much more likely to occur from a receiver that uses a triode as an rf amplifier, than from a receiver with a pentode rf amplifier; this is due to the higher grid-to-plate capacitance of the triode. Since the plate circuit of the rf amplifier is coupled to the mixer stage, an rf tube of higher grid-to-plate capacitance affords a lower attenuation path for the oscillator radiation to pass through the tube and up the transmission line; Fig. 2.

It has been found that the use of an untuned isolation amplifier or booster<sup>1</sup>,  
 (Continued on page 66)

OVER  
2,000,000

3,000,000

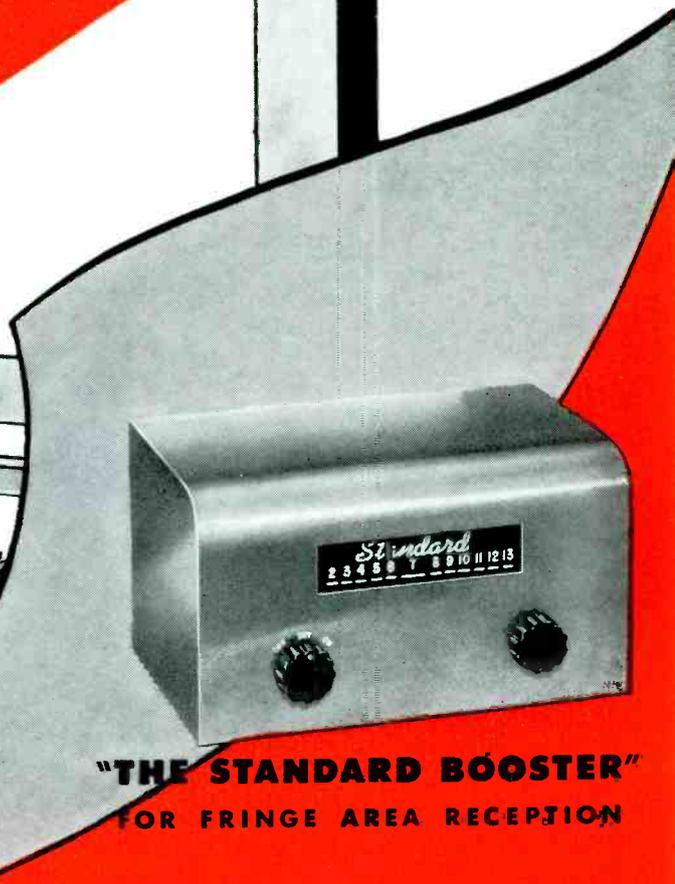
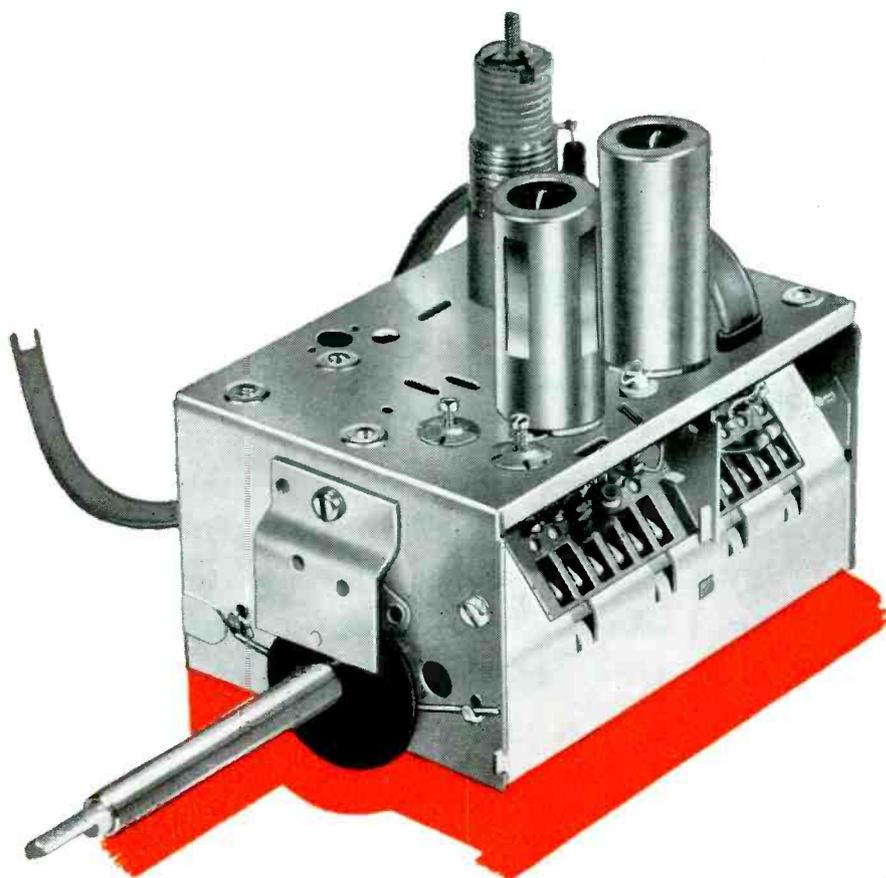
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**"THE STANDARD BOOSTER"**  
FOR FRINGE AREA RECEPTION

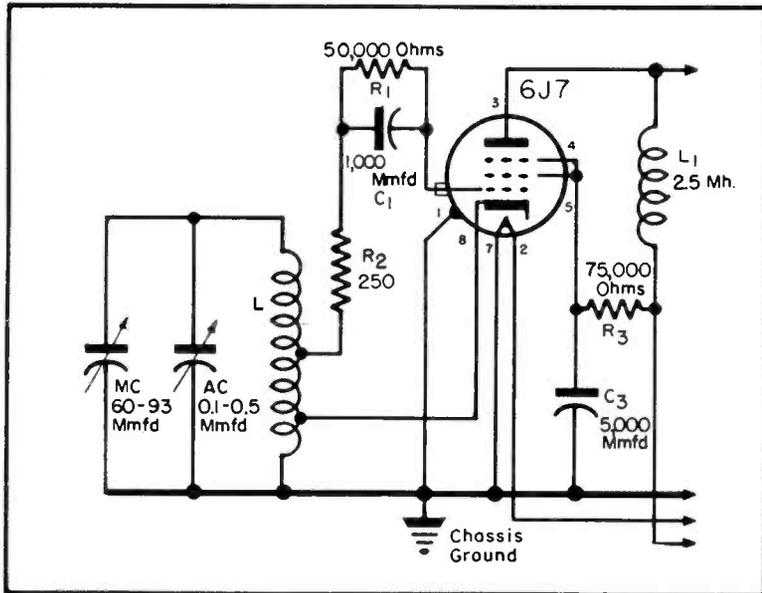


Fig. 1. The ratio-coupled circuit of the micrometer frequency meter. In this system the oscillation frequency is determined largely by the inductance and capacity of the tuned circuit and not by the attached equipment which is required to drive the oscillations.

# Center Frequency Measurement

by WYN MARTIN

FREQUENCY CONTROL is one of the most important factors in the receiver and the transmitter, whether it be an FM, AM or TB type. In the receiver, control of the local oscillator is vital to the overall effectiveness of the circuit. And in the transmitter or laboratory oscillator, accuracy of control is particularly essential. In the instance of the transmitter, tolerance is required by law. Specifically, for transmitters, it has been stipulated that the frequency tolerances below 50 mc should be .01% and .005% above 50 mc. Such control can be supplied by an instrument which provides what is known as center frequency measurement, a term which has been derived from the FCC's

**Control Measuring Technique, Employing Heterodyne Type Band-Spread Instruments, Provides Ideal Means of Checking Frequency of Local Oscillators of Receivers, Lab Oscillators and Transmitters.**

interpretation of the accuracy of the frequency-measurement means. That is, the device should permit readings to one-half the transmitter frequency tolerance.  
(Continued on page 72)

The FCC Regulations require that periodic checks be made to insure that all transmitters are on frequency. The only stipulation as to who shall make the measurement is: . . . "the measurement, at the option of the licensee, be made by any qualified engineering measurement service, in which case, the required record entries shall show the name and address of the engineering measurement service as well as the name of the person making the measurements."  
Pamphlets with the *FCC Rules and Regulations* may be obtained for from 5c to 25c each from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Fig. 3. Exploded view of the dial mechanism.

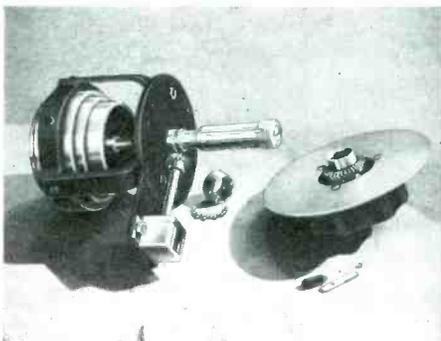


Fig. 2. The micrometer capacitor, showing the rotor, stator, pad and support rings.

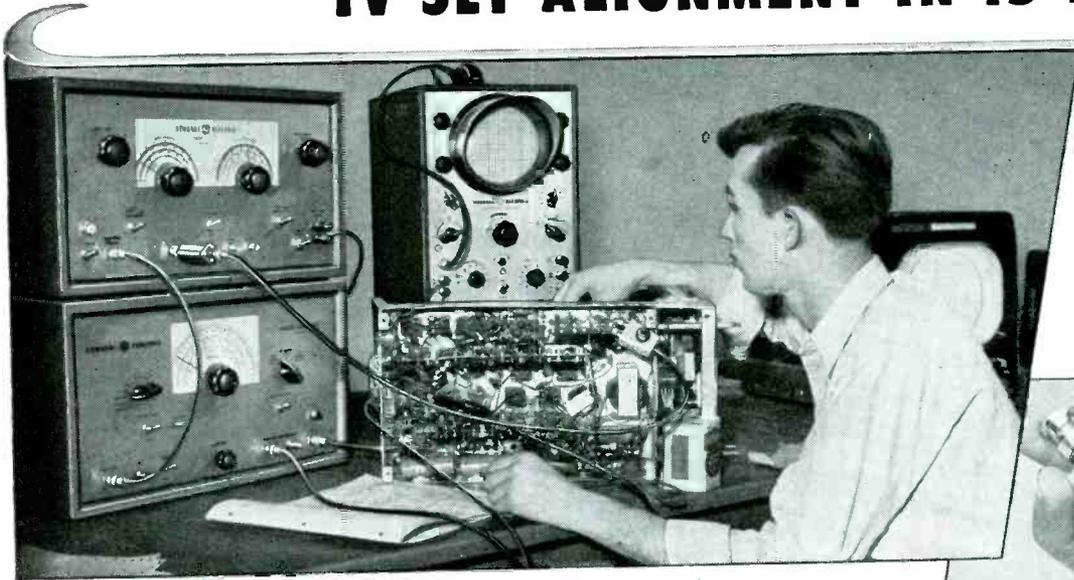


Fig. 4. Exploded view of the micrometer head, tapered rotor and tubular stator.



# "Complete, Accurate

## TV SET ALIGNMENT IN 15 MINUTES!"



Says **JIM OTTMAN**  
**TV Service Supervisor**  
 General Electric Supply Corp.  
 Buffalo, New York



New! Balanced output adaptor (Type ST-8A) permits accurate alignment of balanced input receivers. Now G.E. offers you both single-ended and balanced output.

"COMPLETE alignments used to take us half a day when we used a conventional sweep. Now we do them in 15 minutes with our G-E Test Equipment Package!

"We align 60% of the sets that come into the shop—as an extra service to our customers. Result—we've been getting letters from pleased patrons who say their receivers work better than ever! *This has built our service business faster than anything we've done before.*

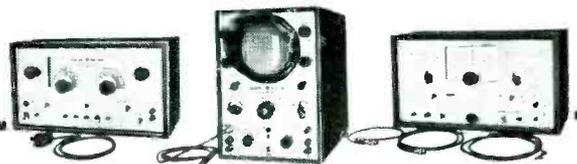
"We now repair most head ends right in the service shop because the G-E Variable Permeability Sweep has enough output to do the job alone. This G-E Package is the only equipment

we've found that will align an inter-carrier circuit receiver quickly and accurately. With it, we get accurate marking of frequency by crystal controlled markers, plus clear visual presentation from the wide-range Cathode Ray Oscilloscope.

"It does more things *better* than any equipment we've ever used. Without it we could never service so many receivers so fast, so accurately!"

That's the opinion of TV Service Manager Jim Ottman, of Buffalo. What this G-E equipment has done for his operation, it will do for yours. It's easy to buy—simple to use—and what a difference in results!

**ASK ABOUT THE G-E EASY BUDGET PLAN!  
 LET THE EQUIPMENT PAY FOR ITSELF!**



General Electric Company — Section 3110  
 Electronics Park  
 Syracuse, New York

Send me complete information on the G-E Television Test Package and new Balanced Adaptor — plus TERMS OF THE EASY BUDGET PLAN.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

*You can put your confidence in—*

**GENERAL  ELECTRIC**

# ASSOCIATIONS



## RTTA

HUGH A. WHITE, sales service engineer for the radio tube division of Sylvania Electric, was the feature speaker at a recent meeting sponsored by the North Central Ohio's Radio and Television Technician's Association and the Burroughs Radio Co.

During his talk, White discussed, in detail, the operation of six specific considerations in television receiver servicing including: a comparison of similarities and differences in radio and television receivers; test patterns and use in frequency analysis; electrostatic and electromagnetic deflection sweep circuits; direct and indirect synchronizing circuits; and the use of test patterns for testing TV sets.

Arrangements for White's talk were made by A. H. Biddle, president of the association.

## NATESA

A NEW ASSOCIATION OF TV and electronic service contractors was formed recently at a meeting in Washington, D. C. The group to be known as the National Alliance of Television & Electronic Service Associations elected Frank J. Moch, president of TISA president; Albert Haas of TCA, Philadelphia, vice president; James Hustad of OTISA (Omaha), secretary, and Bertram Lewis of ARTG, treasurer.

Fred Levine of TISA acted as temporary secretary during the meeting. A seven-man executive committee representing the officers, and Jack Barton of the Detroit Contractors Association, H. Goodhue of Los Angeles and A. E. Rhine of the Television Contractors Association of New York, was also elected. In addition it was decided that there be a 24-man board of directors consisting of the foregoing officers and directors and 17 additional representatives limited to one from any one association who will also assist in the policy making of NATESA.

The Washington legal firm of Mayer, Rigby and Seeley were named to represent the association.

NATESA business will be conducted temporarily through the offices of its president, at 5908 South Troy Street, Chicago.

## ARTSNY

AT THE THIRD FALL MEETING of the Associated Radio-Television Service Men of New York, Walter Buchsbaum, senior engineer of Olympic Radio and Television Company, presented a talk on horizontal *afc* circuits.

Buchsbaum is also the author of the recently published book *Television Servicing*.

## RTG

ALBERT C. W. SAUNDERS addressed a meeting of the Radio Technicians Guild of Rochester, N. Y., recently on *Practical Aids to Television Service*.

The annual fall banquet was held at Locust Lawn.

## TEN YEARS AGO

*From the Association News Page of SERVICE, November-December, 1940*

THE DALLAS RADIO SERVICE Association, heard a talk on tube applications by Walter Jones, Sylvania engineer, during their regular monthly meeting. The presentation was the sixth in a series offered by the association. . . . The Danville chapter of RSA acquired meeting rooms at 113½ N. Vermilion St., Danville, Ill. Through the cooperation of WDAN and the *Commercial News*, the association appealed to the public for discarded receivers to be donated to charity, the receivers to be repaired by the association's members.

. . . George C. Connor, Sylvania commercial engineer, presented a talk on the changes in radio and what they mean to the Service Man, at a meeting of the Long Island chapter of RSA. The meeting, sponsored by Dale Radio Corp., N. Y., Sylvania distributors, was presided over by Otto Furman, past prexy of the association's chapter and instructor in radio communications at the Brooklyn Technical High school. Connor also appeared at a session of the Philadelphia servicing association, sponsored by Norman M. Sewell of Century Radio. . . . The second annual meeting of the Radio Technicians Guild of Rochester was held in conjunction with the Fall Meeting of the IRE and RMA engineering department. . . . A monthly meeting was held by the Whaling City chapter of RTG.

## MTSA

A PROTEST against the recent FCC ruling on the CBS color system was filed recently by the Master Television Servicemen's Association of greater Cincinnati, Ohio.

In a letter, sent by George F. Albright of the Queen City Radio Service Co., on behalf of the organization, the group strongly urged the FCC ". . . to keep open the discussion on the color television question, and to defer settling color television standards until a compatible system offering greater possibilities of future improvement is developed, thus offering the public a color service which will be practical, economical, and of good quality consistent with historic American ingenuity."

## MRSRAP

CONVERSION OF TV SETS for color pickup served as a featured topic during a recent meeting of the Mid-State Radio Servicemen's Association of Pennsylvania.

The subject was discussed by Ed Noll of Temple University.

## ESFETA

THE SUBJECT OF EDUCATIONAL lectures was discussed at a recent meeting of the Empire State Federation of Electronic Technicians Associations, Inc., at the meeting held at Cuneo's Restaurant, Kingston, N. Y., with 24 delegates and officers, representing 10 local technicians' associations, and thirty guests. A special lecture resolution was adopted: "Any local association so requesting, shall have the educational lectures made available to their membership, even if they only have a small membership, and can get only a small attendance."

It was also announced that Margaret Snyder, former association vice prexy, had been married recently and an appropriate wedding gift would be presented to her soon. Margaret, who is now Mrs. Palmiere, is still active in the service world.

# BOOST your sales with the NEW ALLIANCE BOOSTER\*

**Tenna-Scope, like Tenna-Rotor will be backed by national TV advertising that sells!** No other booster will have equal acceptance!

For Tenna-Scope is superior in design for ease of operation and performance. One control for all channels! Automatic switch turns booster on with set. Superbly styled plastic control case blends with all furniture. Exceptional high-channel reception and uniformity of picture and sound! Price \$29.95.

*Actual size 6 1/4" x 5 7/8" x 5"*



*2 perfect companions:*  
\***TENNA-SCOPE**  
**TENNA-ROTOR**

*Actual size  
6 1/4" x 5 7/8" x 5"*



New Deluxe  
Model HIR Tenna-Rotor

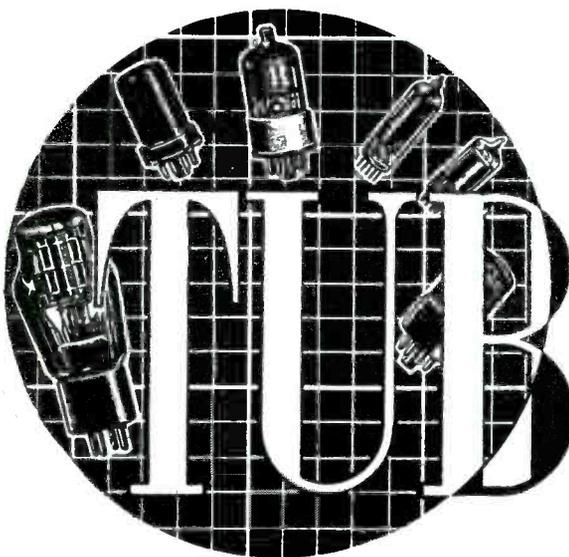
**New Automatic Tenna-Rotor—Model HIR—**just set the pointer—antenna then turns to that point and stops. North—East—South—West. Direction indicator dial shows exact position at all times. May be marked for present or new channels. Guaranteed for one year. Uses special "Zip" feature, 4-conductor cable for fast installation. Advertised in all major TV areas.

**Just set it—and forget it!**

**Alliance Manufacturing Co.**  
**Alliance, Ohio**

Export Department: 401 Broadway, New York, N. Y., U. S. A.

**alliance**  
**TENNA • SCOPE**



# TUBE *News*

by L. M. ALLEN

## Features of Aluminized 16 and 19-Inch Rectangular and Metal-Envelope Picture Tubes, TV Deflection and High-Voltage Tubes, and 7-Inch 'Scope Tube With Anode Voltage of 6000.

WITH THE GROWING INTEREST in larger picture tubes in rectangular and round styles has come the development of many new types with extremely interesting features. At G.E., for instance, the aluminized feature has now been included in rectangular and metal-envelope types.

The aluminized characteristic has been included in a 16-inch rectangular glass envelope. Typed 16KP4A, the tube has an aluminum backed screen with a dark faceplate. The aluminized screen is said to allow the tube to be operated at a lower anode voltage than is feasible with the non-aluminized versions of the tube.

Other features of the tube are an electron gun designed to be used with an external ion-trap magnet. An external conductive coating serves as a filter capacitor when grounded.

Electrical characteristics include: heater voltage, 6.3; heater current .6 ampere  $\pm 10\%$ . Maximum ratings include: anode voltage, 16,000 and grid-No. 2 voltage, 410.

The aluminized feature has also been included in a 19-inch round metal picture tube, 19AP4C.

The 19AP4C also features an electron gun designed to be used with an external ion-trap magnet.

Electrical characteristics of the tube include: heater voltage, 6.3; heater current .6 ampere  $\pm 10$  per cent. Maximum ratings include an anode voltage of 19,000 and a grid-No. 2 voltage of 410.

### 17-Inch Rectangular Tubes

A 17-inch rectangular picture tube is also coming off the G.E. line.

The tube, 17BP4A, with a neutral-density faceplate, is a magnetic-focus-and-deflection type. It has an electron

Sergie Pugliesi, left, Artistic Director of Radio Italy, with Dr. W. R. G. Baker, vice president and general manager of the G.E. electronics department, inspecting a glass rectangular picture tube.



gun designed to be used with an external, single-field ion-trap magnet for the prevention of ion-spot blemish.

Heater voltage is 6.3 and the heater current is .6 ampere  $\pm 10$  per cent.

Two TV receiving tubes have also been announced by G.E. One is a double-ended beampower amplifier tube, 6CD6G, designed for use as the horizontal-deflection amplifier.

When used with suitable components, the tube is said to be capable of fully deflecting any picture tube having a deflection angle up to  $70^\circ$  and operating at anode voltages up to 14 kv.

The 6CD6G is rated with a peak positive pulse plate voltage of 6000; maximum *dc* plate voltage of 700; plate dissipation, 15 watts maximum and *dc* plate current of 170 ma maximum.

A half-wave rectifier tube, similar to the 1X2 tube, except that it has a higher output and input voltage rating, is also now available from G.E. The tube, 1X2A, is suitable for use in both *rf* and fly-back types of power supplies.

Maximum ratings and characteris-

APPLICATION		HEATER VOLTAGES									150 MILLIAMPERE HEATER CURRENT	300 MILLIAMPERE HEATER CURRENT			
		1.4	2.0	2.5	5.0	6.3	12.6	25	35	50			117		
CONVERTERS	GENERAL PURPOSE	PENTAGRID HEPTODE OCTODE	1A7G 1L6 1A7GT 1LA6 1B7G 1LC6 1B7GT 1R5 1E8	1A6 1C6 1C7G 1D7G	2A7		6A7 6A8 6A8G 6A8GT 6B7 6B7Y 6B8 6B8G 6BE6 6D8G	6SA7 6SA7GT 6SB7Y	12A8GT 12A8GT 12BA7 12BA7 12BE6 14B8 12SA7GT 14Q7				6D8G 12SY7 7A8 12SY7GT 12A8GT 14B8 12BA7 14Q7 12SA7GT	6A7 6A8 6A8G 6SB7Y 6A8GT 7B8 6B7 6BE6	
		TRIODE HEXODES TRIODE HEPTODES					6J8G 6K8 6K8G 6K8GT 6K8GT 7D7 7D7 7J7 7S7		12K8 12K8GT 14J7 14S7				7D7 6J8G 12K8 6K8 12K8GT 6K8GT 14J7 7J7 14S7 7S7	6J8G 6K8 6K8G 6K8GT 7J7 7S7	
		MIXERS					6A56 6L7 6L7G								6L7 6L7G
	TELEVISION	DOUBLE TRIODE MIXERS					6J6 12AT7	12AT7						12AT7	12AT7
	PENTODE MIXERS					6AG5 6AK5 6BC5 6CB6									6AG5 6BC5 6CB6
RECTIFIERS	GENERAL PURPOSE — HIGH VACUUM	HALF-WAVE					1-V 811		12Z3	25W4GT	35W4 35Y4 35Z4GT 35Z5GT	45Z3** 45Z5GT**	117Z3 117Z4GT	35Y4 35Z3 35Z4GT 35Z5GT 35Z5GT	1-V 1Z2 1Z2 25W4GT
		FULL-WAVE				5A24 5X4G 5R4GY 5Y3G 5T4 5Y3GT 5U4G 5Y4G 5V4G 5Y4GT 5W4G 5Z3 5W4GT 5Z4 5X3 83V	5X4G 5Y3G 6X4 7Z4 6X5 84/6Z4 6X5GT 6Y5 6Z5 12Z5 6Z5 12Z5 6Z5 12Z5	6AX5GT 7X6 6WSG 7Y4 6X4 7Z4 6X5 84/6Z4 6X5GT 6Y5 6Z5 12Z5 6Z5 12Z5	6Z5/12Z5	25Z5 25Z6 25Z6GT	35Z6G	50X6GT 50Y6GT 50Y6GT 50Y7GT 50Z7G	117Z6GT	50Y6GT 50Y7GT 50Z7G	6Z5 5Y5 5Z5 25Z6 25Z6GT 35Z6G
	DETECTORS	DIODES	1A3 1R4 1294 2B25		9005*		6H4GT 7C4/1203A 9004 9006							1A3 9004 1R4 9006 6H4GT 7C4/1203A	
	DOUBLE DIODES					6AL5 7A6 6H6 6H6GT		12AL5 12H6						7A6 9004 12AL5 12H6	6AL5 6H6 6H6GT
	VOLTAGE DOUBLER	DOUBLE DIODE					6AN6				25Z5 25Z6 25Z6GT	35Z6G	50X6 50Y6GT 50Y7GT 50Z7G	117Z6GT	50X6 50Y6GT 50Y7GT 50Z7G

\* 3.6 V. † 7.5 V. \*\* 45 V.

Classification chart for general purpose and TV tubes used in converter and rectifier applications (Courtesy Tung-Sol)

tics include a peak inverse plate voltage of 20 kv and a peak plate current of 11 milliamperes.

For the audio output stage of TV sets, G.E. has also developed a beam-

power amplifier tube.

The tube, 6W6GT, which is said to be capable of delivering relatively large power output and features high sensitivity, when connected as a tri-

ode, can be used as a vertical deflection amplifier in TV receivers.

Maximum ratings of the tube include a peak-positive pulse plate voltage of 1000, peak-negative pulse grid

Rectifier, voltage regulator and control service chart for general purpose and TV tubes. (Courtesy Tung-Sol)

APPLICATION		HEATER VOLTAGES							150 MILLIAMPERE HEATER CURRENT	300 MILLIAMPERE HEATER CURRENT
		COLD CATHODE	1.4	2.5	5.0	6.3	12.6	25		
RECTIFIERS	TELEVISION — HIGH VACUUM	HIGH VOLTAGE		1B3GT 1X2 1V2 1Y2 1Z2	2V3G 2X2 2X2/879 879					
		VIDEO DETECTOR				6AL5	12AL5		12AL5	6AL5
		DAMPER SERVICE				5V4G	6U4GT 6W4GT		25W4GT	25W4GT
	DC RESTORER					6A57G			6A57G	
	GENERAL PURPOSE — GAS	DOUBLE DIODE				6AL5	12AL5		12AL5	6AL5
VOLTAGE REGULATOR	HALF-WAVE		0V4 0V4G							
	FULL-WAVE		0Z4 0Z4G	82 83						
CONTROL SERVICE	GLOW DISCHARGE DIODE		0A2 0A3/VR-75 0B2 0H3/VR-90 0C3/VR-105 0D3/VR-150							
	GAS TRIODE	1C21		2A4G 2B4 2C4 885		6D4 6Q5G 884				
	GAS TETRODES					2D21 2050 2051				
	RELAY TUBE	0A5								



Portable, Tube

**TROUBLE SHOOTER**

# The ONLY Picture Tube Tester...

# Catho Chek



\* Patents pending,  
trade mark reg.

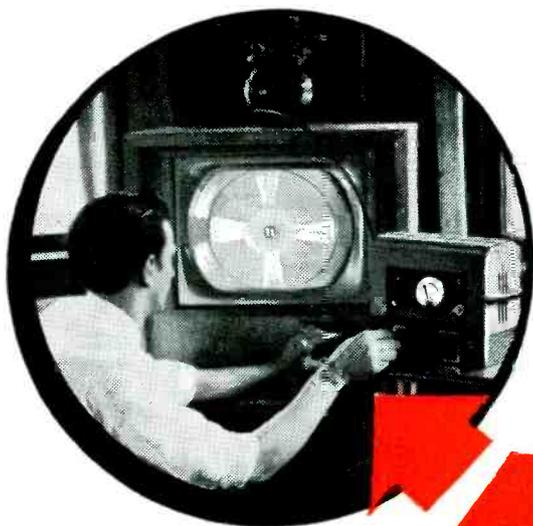
The Thomas Electronics Catho-Chek\* is a portable service unit which eliminates or establishes the picture tube as the cause of an inoperative receiver, in one, easy 60-second operation — and without removal of the tube!

In establishing the tube as the trouble source, Catho-Chek\* eliminates needless lay-up of sets and endless circuit tracking which, by present methods, shows only where the trouble IS NOT. In eliminating the tube as the trouble source it saves your time and the customers' money. Result? — more profitable calls per day for you, and better all-round service for your customers.

## FEATURES

- Checks emission on cathode-ray tubes, reading directly on a 0-1 Ma. meter scale.
- Checks gas ratio.
- Checks shorts and leakages.
- Leakage reads directly on a 0-100 Micro-ammeter.
- All readings possible without tube removal.
- Completely portable.

The Thomas Electronics Catho-Chek\* is designed for use on electro-magnetic cathode-ray tubes having accelerating anodes ONLY. For further information, please write direct to: Dept. S.



**THOMAS ELECTRONICS, Inc.**

118 Ninth Street

Passaic, New Jersey



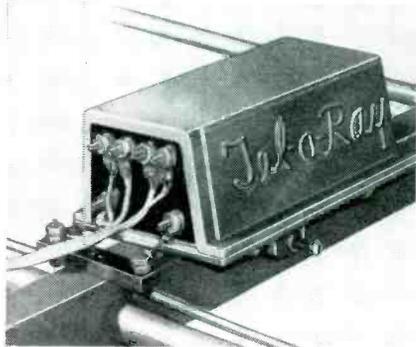
# New TV Parts . . . Accessories

## TEL-A-RAY PREAMPLIFIER

An antenna-mounted preamplifier which can be attached to any folded dipole-type antenna has been announced by Tel-A-Ray Enterprises, Inc., Box 332P, Henderson, Ky.

The device is said to eliminate or greatly reduce *snow*, and deliver more signal with less noise, because of the high signal-to-noise ratio set up.

Amplifier is constructed from dural. The manufacturer claims that unit will withstand damage from high winds, snow, or other elements.



## TRICRAFT UNI-DIRECTIONAL FM-TV ANTENNA

A TV antenna, type P-38, that in a single bay is said to incorporate seven elements has been announced by Tricraft Products Co., 1535 N. Ashland Ave., Chicago 22, Ill. The design of the antenna is said to be such that in the high band three collinear elements are fed with in-phase equal currents.

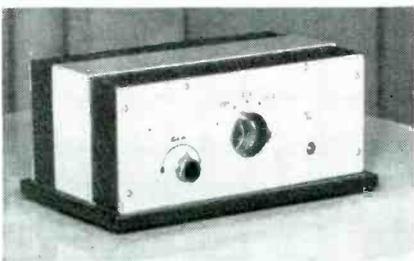
Behind these three elements are placed two collinear reflectors cut for the high television band, and a third longer reflector that is said to be active in increasing forward gain in both the high and low bands.

When operated in the low band the three-fed element group of the high band becomes a single half-wave dipole with the approximately sinusoidal current distribution of any thin half-wave dipole.

The feed arrangement used with the antenna is said to be such that a good impedance match to a 300-ohm line is obtained over both bands.

## TEC BOOSTER

A TV booster, S-505, featuring a gain control and two untuned broad amplifiers, in separate bands has been announced by the Television Equipment Corp., 238 William St., N. Y. City. The untuned amplification feature is said to be particularly effective in intercarrier type TV receivers, providing equal amplification to video and audio signals.



## ARTISAN OVERHEAD LADDER RACKS

Overhead ladder racks for installation on standard pickup truck bodies have been announced by Artisan Products, Inc., 3490 West 140 St., Cleveland 11, Ohio. Of tubular construction, ladder rack kit consists of formed tubular bows, clamps for securing bows to pickup body, ladder guides and spring hold-downs.



## VIDEO ASSOCIATES INDOOR ANTENNA

A non-directional indoor antenna, model Vi-A, which it is claimed can be used in many different planes and directions, has been announced by Video Associates, 1831 Adams St., Toledo 2, Ohio.

Of flat, one-plane construction, the indoor antenna can be hidden beneath the carpet, back of a drapery or behind a picture on the wall. It is provided with an opaque or transparent lead and has a metal slide.

## BRACH 2-SET COUPLER

A 2-set coupler, designed to operate two TV sets from one antenna, has been announced by the Brach Manufacturing Corp., 200 Central Ave., Newark, N. J.

Coupler input receives its signals from one antenna which may use 75 or 300-ohm down-lead. Signals are filtered of *if* interference and divided into two outputs which may, by proper connection, be circuit to either 75 or 300-ohm TV receivers. More than 200 db of isolation to local oscillator radiation is said to be realized between receivers with the 2-set coupler. Coupler is said to have complete isolation in regard to loading effects. A defective connection to either receiver will not affect the operation of the other receiver connected to the coupler.



## RMS LIGHTNING ARRESTER

A two-way-protecting lightning arrester, has been introduced by Radio Merchandise Sales, Inc., 1165 Southern Boulevard, New York 59, New York.

Protection against lightning and static is said to be afforded by means of neon gas discharge and air gap.

The arrester, model LA-2, is said to be completely waterproof, requires no wire stripping and mounts on masts, walls and sills. Single unit takes both regular and jumbo size twin lead. It is UL approved for both indoor and outdoor use.



## SYLVANIA TV PICTURE TUBE TEST ADAPTER

A picture-tube testing adapter, type 228, designed to indicate shorts, leakage and open heaters in electromagnetic picture tubes and also indicate relative emission of types having accelerating anodes, has been announced by Sylvania Electric. In addition, when used with Sylvania tube testers, type 219 and 220, heater-cathode leakage may be checked.

Picture tubes can be tested without removing tubes from TV chassis.

## SNYDER HEAD-LINE TV ANTENNAS

Two TV antennas have been added to the Snyder Manufacturing Co., *Head-Line* series.

One of the new products is a *double-V array*, the AR-55. Antenna features four hi-tensil  $\frac{3}{8}$ " aluminum alloy elements, two  $\frac{1}{2}$ " aluminum alloy cross arms and comes completely pre-assembled.

Second of the new antennas is a pre-assembled *double-V*, TV-55 kit. Has four hi-tensil  $\frac{3}{8}$ " aluminum alloy elements, two  $\frac{1}{2}$ " aluminum alloy cross arms and comes with two mating  $\frac{1}{4}$ " zinc plated lock-seam steel mast sections, 7' erected, and guy ring.



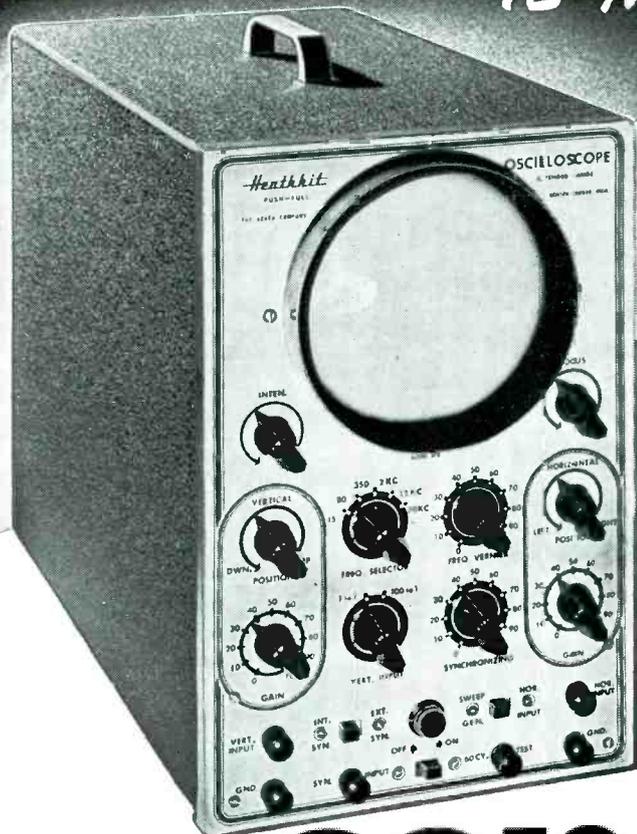
[Additional TV part news appears on page 60.]

12 Improvements IN NEW 1951

MODEL O-6

PUSH-PULL

# Heathkit OSCILLOSCOPE KIT



Only **\$39.50**

## New INEXPENSIVE MODEL S-2 ELECTRONIC SWITCH KIT

Twice as much fun with your oscilloscope — observe two traces at once — see both the input and output traces of an amplifier, and amazingly you can control the size and position of each trace separately — superimpose them for comparison or separate for observation — no connections inside scope. All operation electronic, nothing mechanical — ideal for classroom demonstrations — checking for intermittents, etc. Distortion, phase shift and other defects show up instantly. Can be used with any type or make of oscilloscope. So inexpensive you can't afford to be without one.

Has individual gain controls, positioning control and coarse and fine switching rate controls — can also be used as square wave generator over limited range. 110 Volt transformer operated comes complete with tubes, cabinet and all parts. Occupies very little space beside the scope. Better get one. You'll enjoy it immensely. Model S-2. Shipping Wt., 11 lbs.



Only **\$19.50**

- ★ New AC and DC push-pull amplifier.
- ★ New step attenuator frequency compensated input.
- ★ New non frequency discriminating input control.
- ★ New heavy duty power transformer has 68% less magnetic field.
- ★ New filter condenser has separate vertical and horizontal sections.
- ★ New intensity circuit gives greater brilliance.
- ★ Improved amplifiers for better response useful to 2 megacycles.
- ★ High gain amplifiers .04 Volts RMS per inch deflection.
- ★ Improved Allegheny Ludlum magnetic metal CR tube shield.
- ★ New synchronization circuit works with either positive or negative peaks of signal.
- ★ New extended range sweep circuit 15 cycles to over 100,000 cycles.
- ★ Both vertical and horizontal amplifier use push-pull pentodes for maximum gain.

The new 1951 Heathkit Push-Pull Oscilloscope Kit is again the best buy. No other kit offers half the features — check them. Measure either AC or DC on this new scope — the first oscilloscope under \$100.00 with a DC amplifier.

The vertical amplifier has frequency compensated step attenuator input into a cathode follower stage. The gain control is of the non frequency discriminating type — accurate response at any setting. A push-pull pentode stage feeds the C.R. tube. New type positioning control has wide range for observing any portion of the trace.

The horizontal amplifiers are direct coupled to the C.R. tube and may be used as either AC or DC amplifiers. Separate binding posts are provided for AC or DC.

The multivibrator type sweep generator has new frequency compensation for the high range it covers; 15 cycles to cover 100,000 cycles. The new model O-6 Scope uses 10 tubes in all — several more than any other. Only Heathkit Scopes have all the features.

New husky heavy duty power transformer has 50% more laminations. It runs cool and has the lowest possible magnetic field. A complete electrostatic shield covers primary and other necessary windings and has lead brought out for proper grounding.

The new filter condenser has separate filters for the vertical and horizontal screen grids and prevents interaction between them. An improved intensity circuit provides almost double previous brilliance and better intensity modulation.

A new synchronization circuit allows the trace to be synchronized with either the positive or negative pulse, an important feature in observing the complex pulses encountered in television servicing.

The magnetic alloy shield supplied for the C.R. tube is of new design and uses a special metal developed by Allegheny Ludlum for such applications.

The Heathkit scope cabinet is of aluminum alloy for lightness of portability.

The kit is complete, all tubes, cabinet, transformer, controls, grid screen, tube shield, etc. The instruction manual has complete step-by-step assembly and pictorials of every section. Compare it with all others and you will buy a Heathkit. Model O-6. Shipping Wt., 30 lbs.

EXPORT AGENT  
ROCKE INTERNATIONAL CORP.  
13 E. 40th ST.  
NEW YORK CITY (16)  
CABLE: ARLAB N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 11, MICHIGAN

# New Parts . . . Tools . . . Instruments

## SYLVANIA 7" 'SCOPE

A 7" 'scope has been announced by the radio tube division of Sylvania Electric Products Inc., 1740 Broadway, New York 19, New York.

Instrument incorporates a multivibrator sweep circuit for linear internal sweep from 10 to 30,000 cycles which may be synchronized to 60 cycles, an external signal or signal applied to its vertical input terminal. Balanced, non-astigmatic sweep is said to be assured by push-pull deflection. Terminals are provided for direct connection to horizontal and vertical deflection plates and to the control grid of the cathode-ray tube for intensity modulation.

The vertical deflection amplifier is said to provide a sensitivity of .1 volt rms for one inch peak-to-peak deflection; sine-wave frequency response at full gain flat within 3 db of 1000 cycles value from 7 to 70,000 cycles free of peaking and an input impedance of 1/2 megohm and 34 mmfd.

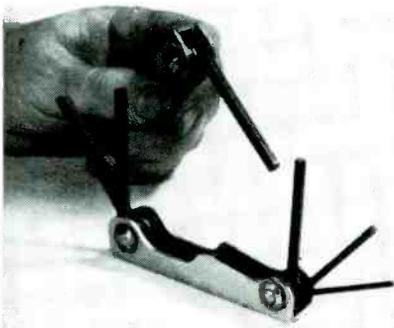
Horizontal amplifier is said to provide a sensitivity of at least .25 volt rms for one inch peak-to-peak deflection; sine wave frequency response within 3 db from 7 to 120,000 cycles; a total deflection of at least 8 1/2", and input impedance of 1/2 megohm and 34 mmfd.

Cross-hatching is provided on a plastic sheet inserted behind the safety glass.



## HUNTER 5-in-1 TOOL

A hand tool with five standard-size, socket-head wrenches that fold knife-like into a single handle, has been announced by the H. D. Hunter Co., Los Angeles. Wrenches are made of tempered steel. Wrenches, which can be ground down, can be replaced by removing the end bolt and inserting a new wrench of the same size.



## PRECISION RECTIFIER SELENIUM RECTIFIERS

Selenium rectifiers which resemble paper capacitors in appearance and do not require mounting holes for installation have been announced by the Precision Rectifier Corp., 131 Boerum St., Brooklyn, N. Y.

Known as *Plastical* rectifiers, the units are said to be completely sealed and yet run adequately cool up to their rated capacities. Available are 40, 65 and 100-ma models.

Illustrated is a 100-ma type; actual size.



## CRL CONTROL KITS

Two new kit deals on *Blue Shaft* controls have been announced by Centralab.

The deals include two assortments of quick-service controls, packed in handy metal cabinets which provide compact storage.

One kit, *B-A*, offers 22 controls, including audio taper, 1/2 and 1 megohms, plain and switch types. *B* types have standard 3" shafts, with full-length fluted mill; *B-S-K* types have 2 1/8" split knurl shafts. The second kit, *B-B* includes 22 assorted plain and switch type controls, all with standard 3" shafts, full-length fluted mill.

## PORTER IMPAKDRIVER

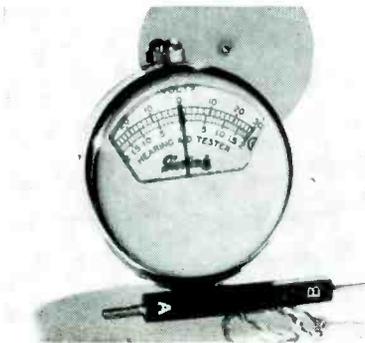
A hand tool, the *Impakdriver*, that is said to be particularly useful for starting stubborn nuts, bolts or screws that are rusted or frozen on, has been announced by H. K. Porter, Inc., Somerville, Mass.

Driver is sold by itself or in sets with different combinations of bits and sockets for various sizes and types of screws, bolts and nuts.

## STERLING HEARING-AID BATTERY TESTER

A hearing-aid battery tester, the No. 12, has been announced by the Sterling Mfg. Co., 9205 Detroit Ave., Cleveland, Ohio.

Voltage range is 30-0-30 v, 1 v and 2-0-2, 1/10 v divisions.



## KNIGHT VTVM KIT

A vacuum-tube voltmeter kit, which includes 4 milliamperer ranges and 6 capacity ranges, in addition to 20 standard *vtrm* ranges has been developed by Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.

Instrument has 30 ranges: *dc* volts (20 megohms input resistance) 7 ranges; *ac* volts (10 megohms input), 6 ranges; *dc* milliamps, 4; ohms, 6; db, 5; capacity, 6 ranges. Reads up to 5000 volts *dc*, 1000 volts *ac*, and to 1000 megohms. Probes are available for extending the *dc* range to 30,000 volts, and for extending the *ac* range to read *rf* to 100 megacycles.

Matched-pair resistors are used for high accuracy. Has zero-center *dc* scale for use in FM discriminator alignment, and pilot light for off-on indication. Uses 4 1/2" meter.



## SIMPSON PANEL INSTRUMENTS

A line of modernistic panel instruments, in three different sizes, has been announced by the Simpson Electric Company, 5200 W. Kinzie St., Chicago.

The models, which were designed by Ray Simpson, come in 4 1/2", 3 1/2" and 2 1/2" sizes. Model numbers are 1029, 1027 and 1127.

Meters have etched faces extending across the entire fronts of the meters, protected with unbreakable plastic. Vertical chrome-plated strips are recessed into the plastic, fluted cover.



[Additional new part-tool-accessory news on pages 54, 55, 58 and 59]

# NEW INDICATOR ION TRAP

Now in all  
**Rauland  
Tubes**



The response to Rauland's new Indicator Ion Trap, after its introduction in the 12LP4-A, has been so enthusiastic that this feature has now been incorporated in all Rauland tubes—as a standard feature of the new Rauland Tilted Offset Gun.

In the field or on the assembly line, this new Indicator Ion Trap reduces Ion Trap Magnet adjustment time to a matter of seconds, eliminates mirrors and guesswork, and assures accuracy of magnet adjustment. It can increase profits for every service man and service dealer—and at the same time assure better customer satisfaction.

A bright green glow on the anode of the picture tube signals when adjustment is incorrect. Correct adjustment is made instantly, by moving the magnet until the glow is extinguished or reduced to minimum.

Only Rauland offers this advanced feature—one of a half-dozen important post-war developments from Rauland.

## **RAULAND**

The first to introduce commercially these popular features:

Tilted Offset Gun

Indicator Ion Trap

Luxide (Black) Screen

Reflection-Proof Screen

Aluminized Tube



## **THE RAULAND CORPORATION**



*Perfection Through Research*

4245 N. KNOX AVENUE • CHICAGO 41, ILLINOIS



**OVER 2 MILLION  
Battery Radios Offer  
Huge PROFIT Market!**

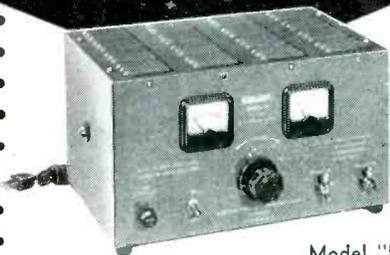


New Model "S"  
BATTERY ELIMINATOR  
with Selenium Rectifier

**CONVERT BATTERY RADIOS  
TO AC ALL-ELECTRIC**

Now is the time your customers want dependable all-electric hum-free performance. Operates any 1.4 volt 4 to 6 tube battery radio from 115 volt 50/60 cycle source. Easily slips into battery space. Guaranteed 3 years ..... **\$10.65 net**

**SAVE TIME, MONEY...  
Servicing DC Equipment  
From AC Lines!**



Model "B"  
POWER SUPPLY  
with Conduction Cooling

**DEMONSTRATE AND TEST  
AUTO RADIOS**

... also relays, 'phone circuits, instruments, other low voltage devices. Only filtered power supply with new conduction cooling. Provides lowest cost per ampere output; unequalled power, efficiency, dependability. Costs less than conventional types. **\$43.50 net**  
6 Volts, 20 amperes....

Ask About New Low Cost "BJ" JUNIOR  
D C POWER SUPPLY. 6 Volts, 12.5 Am-  
peres ..... **\$32.40 net**

**SEND COUPON NOW!**

ELECTRO PRODUCTS LABORATORIES  
4501-SB Ravenswood Ave., Chicago 40, Ill.  
Send new literature and name of nearest  
jobber.

Name .....  
Address .....  
City ..... Zone ..... State .....

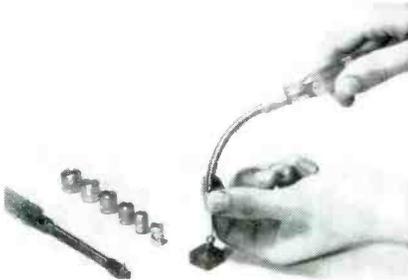


Pioneer Manufacturers of Battery Eliminators

**MILLER FLEXIBLE DRIVE TOOLS**

A line of flexible drive tools, including a flexible socket set and flexible screw driver, has been announced by L. B. Miller Co., 394-396 State St., Stamford, Conn.

The socket set consists of a 1/4" hex flexible drive with an overall length of 8 3/4". Sizes are 3/16", 1/4", 5/16", 3/8", 7/16", and 1/2". Overall length of the screw driver is 8".



\*\*\*

**EICO COUNTER-DISPLAY TUBE  
TESTER KIT**

A counter-display tube tester kit, type 62 5-CK, which measures 4" front height, 7" back height, 14" wide, 16" deep, has been announced by the Electronic Instrument Co., Inc., 276 Newport Street, Brooklyn 12, N. Y.

Tester has individual switches for separate testing of conventional receiving and TV tubes including 4, 5, 6, large and small 7, octal, loctal, noval, Hytron, VR, magic eye and pilot bulbs; blank spare socket for future new tubes; illuminated gear-driven Speed Roll-Chart; two grid caps; protective overload bulbs; vacuum tube rectifier; full-vision bakelite-cased meter.



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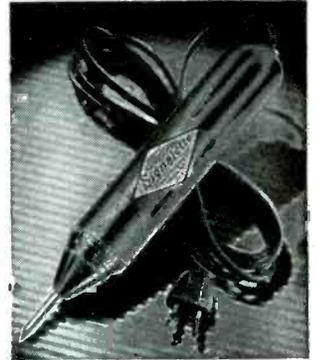
**BUCHANAN SPLICE CAPS**

Splice caps made by the Buchanan Electrical Products Corp., 1290 Central Avenue, Hillside, N. J. for pigtail splicing of electrical wires are now available in an open-end construction which is said to facilitate their installation and inspection.

Only two sizes of splice caps are said to be required for all most frequently used combinations of two or more wires ranging all the way from two No. 18 to three No. 8. Snap-on insulators of fixed insulating value are said to eliminate necessity for taping of joints and insure against insulation breakdown in service.

A hand operated pre-SURE tool installs both sizes of splice caps. This tool features a four-way crimping action, which is said to be equally effective on solid or stranded or on combinations of solid and stranded wires.

**SHOOTS TROUBLE  
FASTER!** Makes more money  
for you on job or  
at service bench!



PRICE  
**\$9.95**  
at distributor  
or postpaid,  
direct. No  
COD's please.  
Ohioans add  
1% State Sales  
Tax.

**Signalite**

**MULTI-FREQUENCY GENERATOR**

In radio service work, time means money. Locate trouble faster, handle a much greater volume of work with the SIGNALITE. As a trouble shooting tool, SIGNALITE has no equal. Merely plug in any 110V. AC-DC line, start at speaker end of circuit and trace back, stage by stage, listening in set's speaker. Generates RF, IF and AUDIO Frequencies, 2500 cycles to 20 Megacycles. Also used for checks on Sensitivity, Gain, Peaking, Shielding, Tube Testing. Wt. 13 oz. Fits pocket or tool kit. Satisfaction, or money back! See at your distributor or order direct.

**Clippard** INSTRUMENT  
LABORATORY  
Inc.

DEPT. C, 1125 BANK STREET  
CINCINNATI 14, OHIO  
QUALIFIED JOBBERS WRITE,  
WIRE FOR DETAILS.

*The World's Finest*  
**LIGHTNING  
ARRESTERS**



**MODEL RW-204**

The first and only lightning arrester that will accommodate 4-wire line for antenna rotator installation as well as regular 2-wire transmission line.

Only **\$1.50** List



**MODEL RW-300**

For use with 2-wire standard antenna ribbon type transmission line for TV or FM. An air gap plus resistors provide double protection.



Only **\$2.00** List

**VEE-D-X**

LaPointe-Plascomold Corp., Unionville, Conn.

**STANCOR LINE VOLTAGE REGULATORS**

A series of line adjusters have been announced by the Standard Transformer Corp., 3580 N. Elston Ave., Chicago 18, Ill. Units are said to permit operation of electrical devices at 115 volts when the supplied voltage is 65, 75, 90, 100, 115, 130 or 145. They meet power requirements up to 750 *va*, 50-60 cycles. The line adjuster input is correctable in seven steps by means of a selector switch and indicated by an output voltmeter. These units are also said to be useful for altering a 115-volt line above or below that level. Equipped with a line cord and plug to fit a standard outlet and a plug-in receptacle to accommodate devices to be operated.



\* \* \*

**SYNDER POLICE TYPE AUTO ANTENNA**

An auto antenna, embodying police and army type construction and mounting features, has been announced by Snyder Manufacturing Co., 22nd and Ontario Sts., Philadelphia 40, Pa.

Antenna, called the *Hot Rod*, features four-section staff of XXX chrome plated Admiralty brass, shock absorbing spring mount, red ceramic insulators and red tenite static ball.

Supplied with 8' of polyethylene cable and aircraft fittings.



**ASTATIC**  
presents new  
perfection in a  
unidirectional  
cardiod crystal  
microphone

**SYNABAR**  
Model DR-10

With Detachable  
Concentric Cable Connector



**DR-10—Code ASVFL**  
LIST PRICE  
**\$37.25**

**DR-10-S\*—Code ASVFK**  
\*With off-on switch  
**\$39.95**

**H**ERE is the microphone the world of professional speakers and entertainers has been waiting for! A host of persons in other categories, too — who are seeking the ideal microphone for a wide variety of sound transmission applications — will welcome this bright new Astatic Microphone development.

The Synabar offers a new measure of clean-toned performance quality . . . and its perfection does not diminish through long service life, thanks to a new ruggedness of its advanced construction. Perhaps the outstanding engineering achievement incorporated in this newly perfected unit is the use of a special sintered metal to cancel out 15 db front to back, making the Synabar, for practical purposes, dead to sound from the rear. Excellent frequency range, from 50 to 10,000 c.p.s., is further enhanced by a Response Selector switch, which provides choice of ideal pick-up characteristics for either crisp voice or general voice and music. The Synabar's crystal element has a special METALSEAL protection against moisture or dryness. A high impedance microphone, it has an output level of —54 db. It has a satin chrome finish, is furnished with 20 feet of single conductor shielded cable, and is available in models with or without an off-on switch.

Astatic is proud to recommend the new Synabar, without reservation, for highest quality reproduction and elimination of extraneous noise.

**THE Astatic CORPORATION**  
CONNEAUT, OHIO  
IN CANADA: CANADIAN ASTATIC LTD., TORONTO, ONTARIO

Astatic Crystal Devices  
Manufactured Under Brush  
Development Co. Patents

### MALLORY TV SERVICE ENCYCLOPEDIA

A 204-page edition of the *TV Service Encyclopedia* has been published by P. R. Mallory & Co., Inc., Box 1558, Indianapolis 6, Indiana. Offered are detailed listings of controls, capacitors, vibrators, tube complements and alignment data, with the original part number and correct replacement, for not only TV chassis but the latest AM and FM receivers. About 150 pages are devoted to this comprehensive coverage.

Also presented are 616 control circuits employed in the various models listed, which are also cited in the listings to facilitate installation and servicing. In addition, there are 332 circuits of capacitor arrangements which are also included in the listings. Within these capacitor circuits are illustrated the methods used to connect up filters, vibrators, etc.

A glossary of radio and TV terms is also featured in the manual, with sections devoted to a series of special circuit notes on controls, capacitors and vibrators.

The encyclopedia is priced at \$1.50.

\* \* \*

### RIDER'S TUBE SUBSTITUTION BOOK

A *Receiving Tube Substitution Guide Book* by H. A. Middleton, has been published by John F. Rider Publisher, Inc., 480 Canal St., New York, N. Y.

Systematically listed in numerical sequence are 2,500 radio and television receiving tube types with accompanying wiring instructions for making the substitutions. Views of the original tube sockets and the substitute sockets are also shown.

Additionally, the guide contains information on *crt* characteristics, instructions for making adaptors, ballast tube data, pilot light information, resistors-capacitors-transformer color codes, transformer substitution, fixed capacitor substitution, and converting farm radio to electric operation.

Book contains 208 pages and is priced at \$2.40.

\* \* \*

### NEWCOMB PORTABLE AUDIO EQUIPMENT DATA

A catalog describing portable sound equipment designed especially for schools, churches, clubs, recreational activities has been announced by Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif. Shown are combination transcription players and public address systems with both 2 and 3-speed turntables.

\* \* \*

### TACO TV ANTENNA GAIN CHART

An engineering bulletin, No.64, which contains actual measurements in db gain over half-wave dipoles for all popular antenna types, has been published by the Technical Appliance Corp., Sherburne, N. Y.

Information is based on actual laboratory and field tests conducted at the Taco labs.

### PERMOFLUX NAMES REX MUNGER JOBBER SM

Rex L. Munger has been named jobber sales manager of Permoflux Corp., Chicago, Illinois. Formerly Munger was sales manager of Taylor Tubes, Inc.



Rex L. Munger

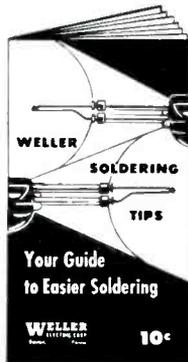
\* \* \*

### WELLER VEST-POCKET SOLDERING COURSE

A new edition of *Soldering Tips*, a 20-page pocket manual of soldering, has been announced by Weller Electric Corp., Easton, Pa.

The handbook describes time-saving methods, *do's* and *don'ts*, fluxes and solder tables, difficult operations, etc.

Copies may be obtained by sending 10¢ in coin to Weller Electric.



\* \* \*

### MORIN NOW SHURE DISTRIBUTORS' DIVISION SALES MANAGER

Joe H. Morin has been named sales manager of the distributors' division of Shure Brothers, Inc., Chicago.



J. H. Morin

\* \* \*

### SONOTONE EXPANDS

A new plant, a single-story building with 20,000 square feet of floor space, and working positions for 425 persons has been opened by Sonotone Corporation, Elmsford, New York.

Sonotone Corp., has started production of miniature tubes for radio and television sets.

[Additional news on pages 61, 62 and 63.]

### HARTER PROMOTED BY CRL

Wickham Harter has been appointed sales manager of CRL mechanical-electronic products, embracing the sales activities of the variable resistor and switch divisions. Harter will also give executive supervision to distributor, export and CRL advertising departments.

Robert A. Mueller, who has been sales assistant to Harter, has been appointed distributor sales manager.

Douglas Thatcher has been appointed sales manager of ceramic-electronic products, including the sales division for ceramic capacitors, printed circuits and teatite.

\* \* \*

### CLAROSTAT CONTROL AND RESISTOR CATALOG

A 20-page catalog, No. 50, describing resistors, controls and resistance devices has been published by the Clarostat Mfg. Co., Inc., Dover, New Hampshire. Various types and sizes of composition-element and wire-wound controls are cataloged, together with *ad-a-switch* and *pick-a-shaft* features whereby one can combine desired electrical and mechanical requirements. Also cataloged are cement-coated power resistors, flexible glass-insulated resistors, plug-in ballasts and voltage dividers, automatic line voltage regulators. Other items are TV beam benders, constant-impedance output attenuators, L-pads, T-pads, and the Clarostat power-resistor decade box.

\* \* \*

### SPRAGUE TV CAPACITOR REPLACEMENT MANUAL

A sixteen-page TV replacement capacitor manual, listing critical replacement capacitors in 497 television models manufactured by 55 different manufacturers, is now available through distributors of the Sprague Products Company, North Adams, Massachusetts.

\* \* \*

### EICO TEST EQUIPMENT CATALOG

A 4-page catalog describing a line of vacuum-tube voltmeters, 'scopes, sweep generators, signal generators, tube testers, signal tracers, volt-ohm-milliammeters, battery eliminators, high-voltage probes, *rf* probes, and crystals has been released by the Electronic Instrument Co., Inc., 276 Newport Street, Brooklyn 12, New York.

\* \* \*

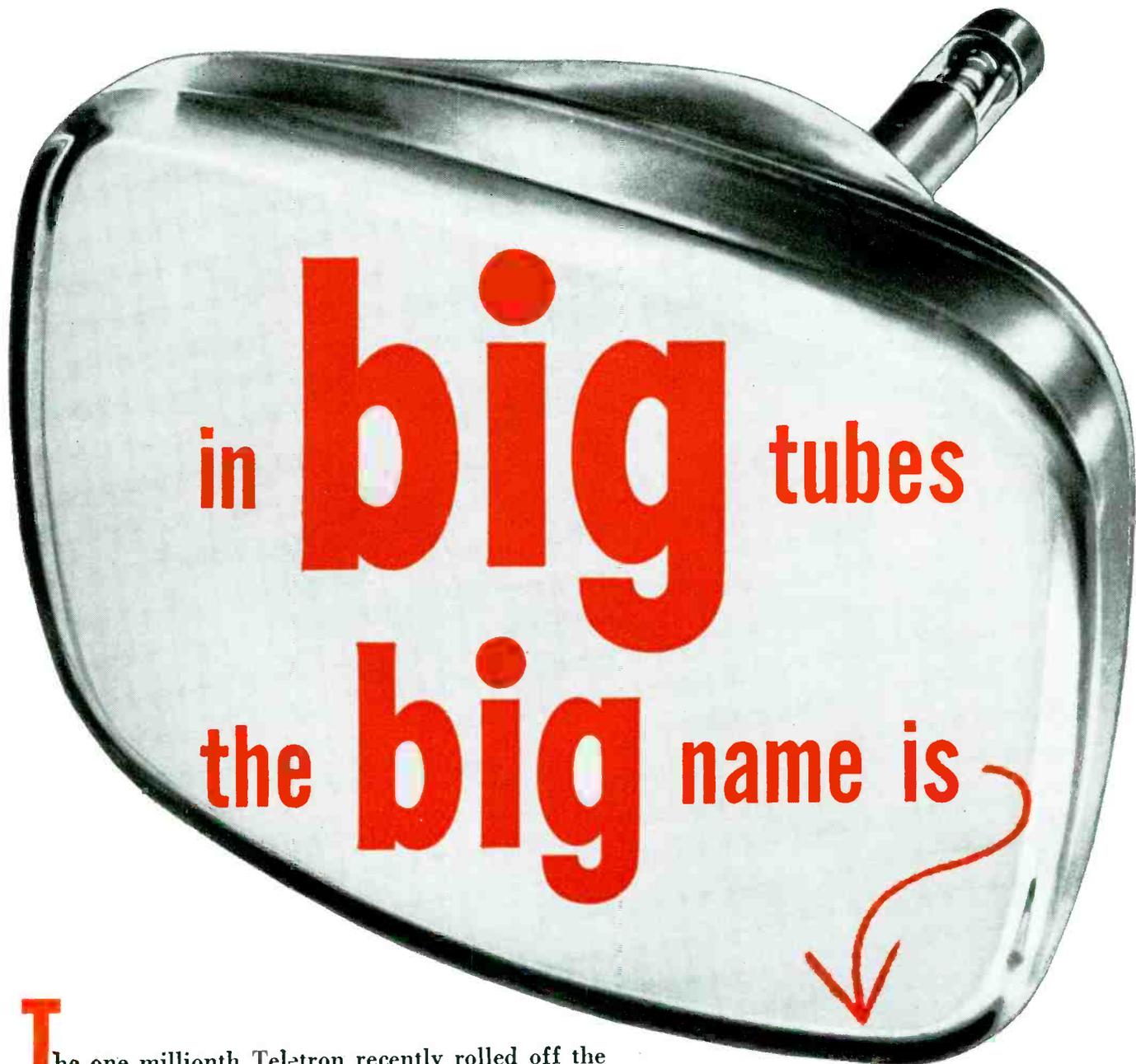
### WOOD AND NEWITT JOIN ELECTRO-VOICE ENGINEERING STAFF

John Wood and William Newitt are now on the lab staff of Electro-Voice, Inc., Buchanan, Mich. Wood is engaged in phono-pickup development. Newitt is continuing work on high fidelity loudspeaker design.

\* \* \*

### ERIE CAPACITOR BULLETIN

A four-page bulletin covering button silver-mica capacitors, disc and plate ceramic, tubular trimmers, feed-thru ceramic, is now available from Erie Resistor Corp., Erie, Penna.



in **big** tubes  
the **big** name is

**T**he one millionth Teletron recently rolled off the production line. It was all in the day's work for Du Mont's vast Allwood plant geared to over a million TV picture tubes a year. Yet that tube established a unique record, because it represented the one millionth BIG TUBE. No other manufacturer has made that many BIG TUBES.

Ever since 1939 when Du Mont introduced the first commercial television set with its 14" Teletron, Du Mont has pioneered BIG TV TUBES. While others were offering 7" and 10" tubes, Du Mont was satisfied with nothing less than 12". Even as early as 1939, Du Mont made 20" Teletrons. Since then the public and industry have followed the Du Mont lead, but Du Mont remains in the lead with still larger tubes climaxed by the 30" Teletron available shortly.

Obviously, in BIG TUBES the BIG NAME is DU MONT.

**DU MONT**  
*Teletrons\**

*First with the Finest in Television*

Literature on request

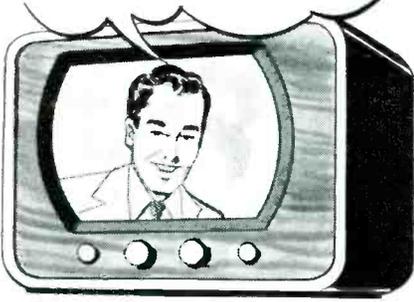
\*Trade-Mark

**ALLEN B. DU MONT LABORATORIES, INC.**  
TUBE DIVISION • CLIFTON, N. J.

SERVICE, NOVEMBER, 1950 • 57

# Eliminate Noise!

(VISUAL AND AUDIBLE)



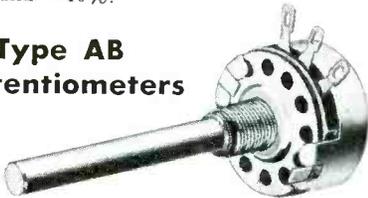
## Use OHMITE REPLACEMENTS



### Little Devil Composition Resistors

Molded plastic construction completely seals and insulates these tiny, rugged units. They have an extremely low noise level. Resistance and wattage clearly marked on each unit. Available in 1/2, 1, and 2-watt sizes, in all RMA resistance values. Tolerances: ±5% and ±10%.

### Type AB Potentiometers



It's quiet! This Type AB Potentiometer has a resistance unit that's solid molded. As a result, the noise level often becomes less with use. Has a 2-watt rating with a good margin of safety. Is unaffected by extremes of heat, cold, or moisture. Available with either 2" round shaft, or short, locking screwdriver shaft.

### New Ohm's Law Calculator

Solves Ohm's Law, parallel resistance problems. Also has slide rule scales.



25¢

OHMITE MANUFACTURING CO.

4879 Flournoy St. Chicago 44, Illinois

Be Right with

# OHMITE

Reg. U. S. Pat. Off.

RHEOSTATS • RESISTORS • TAP SWITCHES

### CLAROSTAT AUTOMATIC LINE-VOLTAGE REGULATOR

Automatic line-voltage regulators are now available from the Clarostat Mfg. Co., Inc., Dover, N. H.

With male and female Edison connections at either end, unit plugs in between the TV set's attachment plug and the outlet. Two models are available: TV-A rated at 300 watts, for sets consuming 200 to 300 watts, and TV-B rated at 375 watts, for sets consuming 300 to 375 watts.



\* \* \*

### SUN RADIO MULTIPLE OUTLET BOX

A portable power outlet box which permits plugging-in of eight standard Edison line cord plugs from one outlet is now being distributed by Sun Radio & Electronics Co., 122-124 Duane Street, New York City.

Incorporated are two fuses with fuse extractors, preventing overloads, or short-circuits traveling to the main fuse box. A double-pole, single-throw toggle switch turns off both legs of all eight receptacles. A neon pilot light indicates power flowing through switch. A 12' rubber-covered cord terminates in an unbreakable plug.



\* \* \*

### RCA PORTABLE RADIO PACKS

Batteries for the Emerson line of portables have been announced by the RCA Tube Department.

One type, the VS082, is a small-size 67 1/2-volt B, and another, VS068, a six-volt A, are companion batteries for use in the Emerson models 569-A and 584. The VS069, a 1 1/2-volt A, and the VS072, a 4 1/2-volt A battery, are for use in Emerson models 645 and 646-A, respectively.

\* \* \*

### VIBRATION RESEARCH VIBRATORS

A line of high-frequency vibrators and power supplies has been announced by Vibration Research Laboratories, Inc., 152 Sanford Street, Brooklyn, New York. Now being made are 180-cycle vibrators in two sizes: 2 1/8" diameter x 3" high and 1 1/4" diameter x 2 1/4" high.

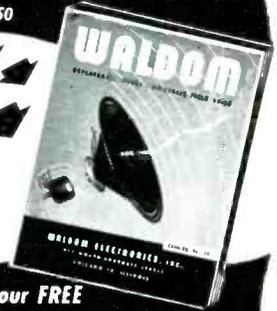
Production is scheduled soon for vibrators up to 400 cycle operation.

# WALDOM

## Replacement Cone Manual

Catalog No. 50

For  
Finer  
Tone  
a Waldom  
Cone



Write for your FREE Copy of this handy catalog Today!

Waldom's Free 24-Page Replacement Cone Manual is a handy reference that speeds up your repair jobs — which means more profit to you! This reference manual lists excellent replacement data for over 75 different TV, FM, and AM Sets. Write today for your Free copy. Just send your name and address to Dept. S.



Waldom Replacement Cone Assemblies are manufactured with the highest standards of precision workmanship and technique! Waldom Cone Assemblies feature:

- Hawley diaphragms — with the patented thin, tapering edge that assures maximum speaker efficiency and true low frequency response.
- The finest voice coils and spiders made with precision craftsmanship to exacting specifications.
- Unconditionally Guaranteed as to construction and performance.
- The full R.M.A. Warranty.

For Finer Tone a Waldom Cone

WALDOM ELECTRONICS, INC.  
911 N. Larrabee St., Chicago 10, Ill.

## GET THIS FREE "W-J" CATALOG!

Thousands of Television, Radio and Electronic Items at Your Finger-Tips!



Fast, Easy Selection

Saves Time

Saves Money

Simplifies Parts Procurement

Complete buying guide for servicemen, dealers. New TV accessories, TV installation equipment, TV test instruments, tubes, radio accessories and other electronic supplies. Thousands of repair parts cross-indexed for quick, easy selection. Standard brands. Exact duplicate replacements. Fast, same-day shipment. Profit Guide sent only to those entitled to wholesale prices.

Send Coupon for Your Free Copy Now

WALKER-JIMIESON, INC.

311 S. Western Ave., Chicago 12, Illinois

Please Send Your Free Profit Guide.

Name .....

Company .....

Address .....

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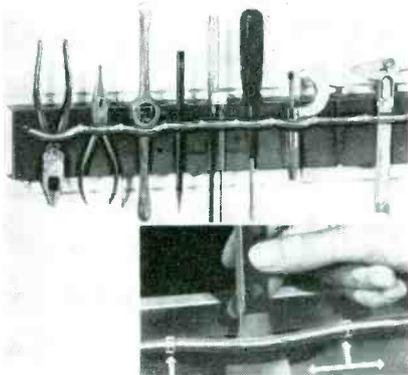
Zone .....

State .....

**GRIP-R SELF-ADJUSTING TOOL HANGER**

A hanger of self-adjusting sliding ring-clips, the *Grip-R*, employing a 22-gauge open-end metal shell 18" long, 2 3/4" wide and 5/8" thick, has been announced by Hobby Hill, 14 N. Michigan Ave., Chicago 2, Ill. Running along the entire length of the shell is a series of slots for holding the sliding ring-clips. Directly in front of the line of slots is a 5/16" plated coil spring which is held in position by the sliding ring-clips, and at each end by the screws which mount the unit to wall, over workbench or as desired.

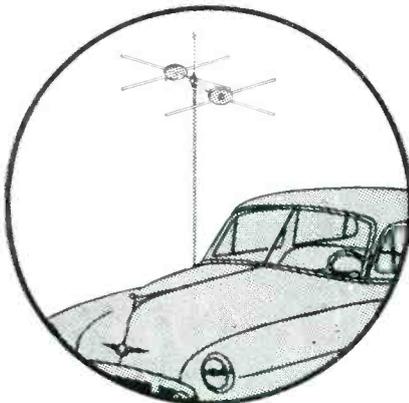
In use, the sliding ring-clips are moved to right or left to make the holding space of the correct size for taking the item to be held, and the item is then inserted between the coil spring and the metal shell surface.



\* \* \*

**INSULINE AUXILIARY AUTO ANTENNA**

A miniature double-conical auxiliary auto antenna, the Tele-Con, patterned closely on a TV antenna has been announced by the Inuline Corporation of America, 3602 35th Avenue, Long Island City 1, N. Y. Has four arms 10 1/2" long, made of chrome-plated brass tubing, set in red plastic center pieces. The assembly clamps to any vertical auto antenna.



\* \* \*

**CLAROSTAT GREENOHM RESISTORS**

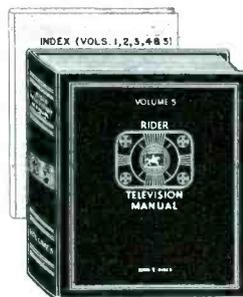
Wire-wound resistors, *Greenohm* type, with a new type of inorganic green cement coating, have been announced by the Clarostat Mfg. Co., Inc., Dover, New Hampshire. It is claimed that the color coating will not blister, crack or peel as a result of heat.

Resistors are available in either fixed or variable types with choice of various terminal ends such as lug, wire, or combinations. Ratings range from 5 to 200 watts.

# With RIDER MANUALS you can turn the tough TV repairs into "PUSHOVERS"

Don't waste time, patience and money trying to "dope out" the repair. Reach for your RIDER MANUAL! Just look up the make and model and follow the accurate, authentic servicing information!

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Authentic, Accurate, Reliable Servicing Information DIRECT From the Engineering Depts. of 74 TV Manufacturers!

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**NOTE:** The C-D Capacitor Manual for Radio Servicing, 1948 Edition No. 1, makes reference to only one source of receiver schematics—Rider Manuals.

**JOHN F. RIDER PUBLISHER, Inc., 480 Canal Street, New York 13, N. Y.**

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## RIDER MANUAL Volume XXI

With a RIDER MANUAL Volume XXI in your Library you can sail through any servicing job on any AM-FM radio receiver built from December, 1949 through October, 1950. The same goes for auto receivers, record changers, tuners, disc and tape recorders. All information comes DIRECT FROM THE MANUFACTURERS (61 of them) and is compiled by RIDER into easy-to-follow form. There are 586 models, 351 chassis, with all pages and double spreads filed in proper place. All you have to do is to look up the make, model, chassis in the index... and let the factory-authorized servicing information help you do a better, faster, more profitable servicing job. 1648 Pages Plus Cumulative Index Volumes 16 through 21.  
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**NOTE:** The Mallory TV Service Encyclopedia, 1st TV Edition, makes reference to only one source of TV receiver schematics—Rider TV Manuals.

**NOTE:** The Mallory Radio Service Encyclopedia, 6th Edition, makes reference to only one source of radio receiver schematics—Rider Manuals.

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Model "WS"\*



**IT'S VERSATILE!  
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Servicemen find this cartridge a real convenience . . . as the one cartridge will take care of most replacements . . . there is no need to carry a large stock in your repair kit. It comes in a Dri-Pack container . . . it has all the performance features to meet requirements. Your investment for stock is a minimum.

Ask your jobber for Bulletin RC162, review all its features, then buy Featheride Replace-All Cartridge Model "WS". Webster Electric Company, Racine, Wisconsin. Established 1909. \*Patents Pending

### FEATURES

- Three terminal construction provides either 1½ volts or 4 volts at ¾ ounce tracking pressure.
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- Only ¾ ounce tracking pressure.
- Factory tested, osmium tipped removable needle for 78 r.p.m. records furnished. Replacement needles also available.
- Crystal is Dri-seal coated to protect it against moisture and humidity.
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**WEBSTER ELECTRIC**  
RACINE • WISCONSIN

"Where Quality is a Responsibility and Fair Dealing an Obligation"

### EASY-UP ROOF MOUNT

A roof mount, EZ-9, has been announced by Easy-Up Tower Co., Racine, Wisc. The mast mount is of all-steel galvanized construction and accommodates masts up to 1½" od. A companion model, EZ-9A, takes masts up to 2" od. It is designed for straddle mounting over the roof peak as shown, or on a slanted or flat surface. A four-way hinge arrangement is said to permit the mast to be *walked up* along the peak or tipped up from either side.



### TRIO YAGIS

A yagi that is said to provide 10 db gain on each of two channels has been announced by the Trio Manufacturing Co., Griggsville, Ill. Available for channels 4 and 5 in the low band, and channels 7 and 9 in the high band.

Antenna consists of four elements whose functioning is different on the two channels. For example, in one model, 445, the elements on channel 4 act as reflector, dipole, director, director in that order; while on channel 5, the same elements act as reflector, reflector, dipole, and director.

The 2-channel yagi is available in single bay, conventionally stacked 2-bay array and as a *controlled pattern* system utilizing 2 bays, off-set stacked and tuned with a *phasitron* that is said to eliminate venetian blind effect caused by co-channel interference.

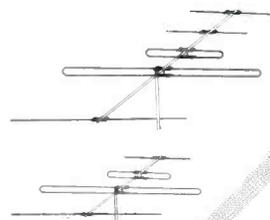
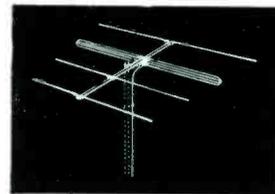
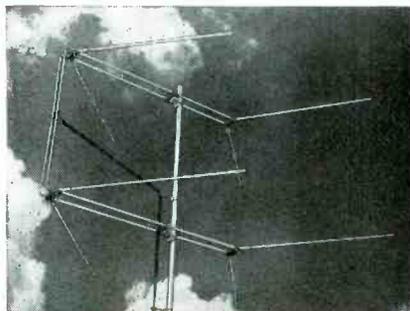
### TACO TWIN-DRIVEN CORNER ANTENNA

An all-driven-element antenna has been announced by Technical Appliance Corporation, Sherburne, N. Y.

Designated as the 1700 series and called the *twin-driven corner antenna*, its driven elements are said to afford narrowed directivity of reception, thus minimizing ghosts caused by reflected signals. Both high- and low-band lobes are said to coincide due to the phase relationship controlled through feeding.

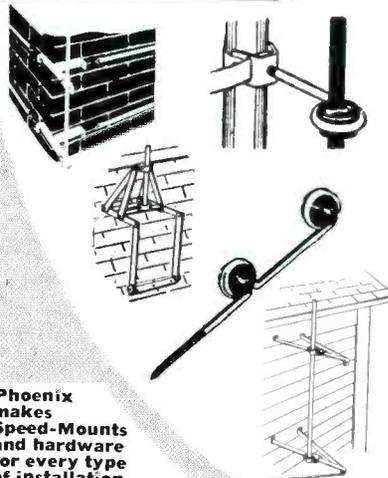
Assembly is accomplished by means of the *jiffy-rig* type of construction.

Antennas are available in single or stacked models.



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**BRACH PROMOTES  
BERGER AND HARRIS**

Jerome Berger, formally manager of the devices division and plant superintendent, has been named assistant sales manager of the Brach Manufacturing Corp.

Berger will be responsible for specialized sales engineering programs for TV manufacturers and their distributors who incorporate the 2, 4, and 16 set TV Multi-Tel system and their TV set sales campaign, and for the sale of custom and brand products. Berger will also act as assistant to Ira Kamen, Brach director of TV sales.

Robert Harris, who was formerly a sales rep on Brach TV products, is now with the Brach engineering department. During the war Harris was a radar technician. He studied high frequency engineering at MIT and Stevens Institute of Technology.



Jerome Berger



Robert Harris

\* \* \*

**SNYDER TV CATALOG**

A '51 catalog listing antennas and accessories has been issued by Snyder Manufacturing Co.

Catalog contains information and illustrations on the Redi-Mount line, and the Head-Line series of TV antennas and accessories including masts, anchors, brackets, clamps, bases, guy rings, insulators and spare elements. Also in the catalog are portable indoor TV antennas, window antennas, etc.

Copies may be obtained by writing to Dick Morris at Snyder Manufacturing Co., 22nd and Ontario St., Philadelphia 40, Penna.



\* \* \*

**HARRY ADELMAN NOW WITH  
CORTLANDT CO.**

Harry Adelman has been named advertising manager of The Cortlandt Co., 243 Broadway, New York 7.

**ROBERT DOWD BECOMES  
TEL-O-TUBE CHIEF FIELD ENGINEER**

Robert Dowd is now chief field engineer of the Tel-O-Tube Corporation of America, East Paterson, N. J.

Prior to this appointment Dowd served with Tel-O-Tube as head of its quality control department.

\* \* \*

**TONY NAMED RCA VICTOR DIRECTOR  
OF PUBLIC RELATIONS**

James M. Toney, advertising manager of the RCA Victor Home Instruments Department, has been appointed director of public relations of the RCA Victor Division. Toney succeeds John K. West, who is now with NBC as vice president in charge of its western division.

Thomas J. Bernard continues as assistant director of public relations.

**SYLVANIA ELECTRIC APPOINTS  
R. P. CLAUSEN RADIO TUBE  
DIV. CHIEF ENGINEER**

R. P. Clausen, formerly assistant chief engineer, is now chief engineer of the radio tube division, of the Sylvania Electric Products Inc., Emporium, Penna. Clausen succeeds M. A. Acheson who has been transferred to the staff of E. Finley Carter, vice president in charge of engineering at New York.

\* \* \*

**WRIGHT CATALOG**

A 10-page catalog describing pm speakers, cabinets, harmonic baffles, flush-mounting grilles, line and universal transformers, has been announced by Wright, Inc., St. Paul 4, Minn.

**HICKOK** Dynamic Mutual  
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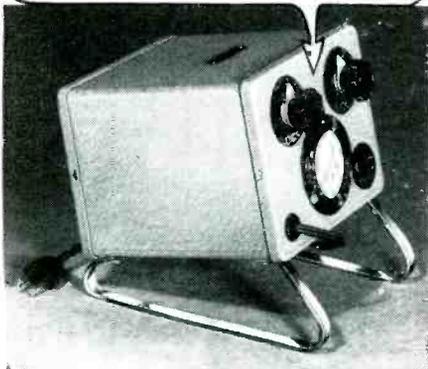
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**Halldorson's NEW  
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A new, larger capacity transformer that provides positive control of your voltage fluctuations—better than ever, and *safer* because it isolates you from your work. Raises voltage or lowers it—in 1½ volt steps—high for locating weak points, low for testing under minimum conditions. Handles the smallest or largest servicing job, *even up to 20" TV Combinations!*

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- Vertical Blocking Oscillator Transformers
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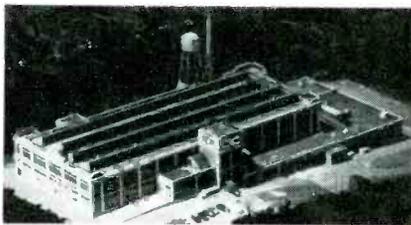
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**SOLAR PLANT PURCHASED BY  
PYRAMID ELECTRIC**

The former Solar plant at 1445 Hudson Boulevard, North Bergen, N. J., with 120,000 square feet of factory space has been purchased by the Pyramid Electric Co., 155 Oxford St., Paterson, N. J.

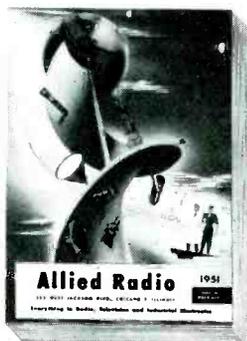


\* \* \*

**ALLIED'S 1951 CATALOG**

A 212-page 1951 buying guide, No. 124, has been published by Allied Radio Corp., 833 West Jackson Blvd., Chicago 7, Ill.

Catalog contains listings of radio, television and electronic parts; test equipment, public address systems, television and radio sets and accessories, TV components, recording equipment and accessories (including wire, tape and disc recorders), 3-speed record players and changers; high-fidelity amplifiers, speakers tuners and other components for custom installations, as well as complete high-fidelity phono-radio systems, amateur gear, radio builders' kits and supplies, tools and hardware, books, manuals, diagrams, etc.



**ELECTRONICS TECHNICIANS  
WANTED**

The RCA Service Company, Inc., a Radio Corporation of America subsidiary, needs qualified electronics technicians for U. S. and overseas assignments. Candidates must be of good character and qualified in the installation or maintenance of RADAR or COMMUNICATIONS equipment or TELEVISION receivers. No age limits, but must have at least three years of practical experience.

RCA Service Company offers comprehensive Company-paid hospitalization, accident and life insurance programs; paid vacations and holidays; periodic review for salary increases; and opportunity to obtain permanent position in our national and international service organization, engaged in the installation and maintenance of AM, FM and TV transmitters, electronic inspection devices, electron microscopes, theatre and home television, r-f heating equipment, mobile and microwave communications systems, and similar electronic equipment.

Base pay, overseas bonus, payments for actual living and other expenses, and benefits mentioned above add up to \$7,000 per year to start for overseas assignments, with periodic review of base salary thereafter. Openings also available at proportionately higher salaries for specially qualified technicians with supervisory ability.

Qualified technicians seeking an advantageous connection with a well-established company, having a broad-based, permanent peacetime and wartime service program, write to:

**Mr. G. H. Metz, Personnel Manager**  
RCA Service Company, Inc.  
Camden 2, New Jersey

**JFD LIGHTNING ARRESTER DISPLAY**

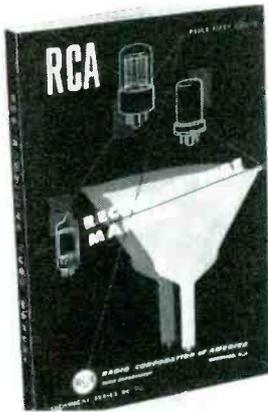
Laminated lithographed displays, 14¾" x 15½", showing a wall installation of an actual lightning arrester, have been made available by the JFD Manufacturing Co., Inc., 6101 Sixteenth Avenue, Brooklyn 4, New York. Also displayed are the three types of twin lead transmission lines accommodated by JFD lightning arresters: regular, oval jumbo and tubular.



**RCA RECEIVING TUBE MANUAL**

A new edition of the *RCA Receiving Tube Manual* has been announced by the RCA Tube Department.

The new manual, RC-16, contains over 300 pages, with detailed technical information on more than 460 RCA receiving tubes and picture tubes including many discontinued types. The section on tube and circuit theory has been expanded and includes formulas and examples for calculation of power output, load resistance, and distortion for several classes of amplifier service.



\* \* \*

**FELBER NAMED STEWART-WARNER SERVICE MANAGER**

Robert W. Felber has been named sales service manager of Stewart-Warner Electric.

Felber started with Stewart-Warner as an engineering draftsman in 1945. He was subsequently a field engineer and assistant service manager.



R. W. Felber

\* \* \*

**RIDER'S TELEVISION MANUAL VOLUME 5 PUBLISHED**

Rider's Television Manual, Volume 5 published by John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y., is now available.

Volume offers factory-authorized servicing data from 74 manufacturers for the period March through July, 1950. Contains 614 models and 250 chassis in the equivalent of 2,320 pages (8½ x 11). A cumulative index for Rider TV Manual volumes 1 through 5 is also included. Priced at \$21.00.

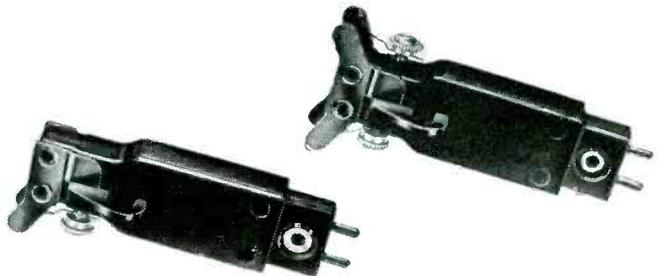
\* \* \*

**CLAROSTAT TV CONTROL AND RESISTOR REPLACEMENT DATA**

Data sheets covering TV control and resistor replacements have been released by Clarostat Mfg. Co., Inc., Dover, New Hampshire.

Sheets refer to RCA, Du Mont, Stromberg-Carlson, Crosley and Emerson models. Charts indicate model and chassis, stock and part numbers, Clarostat catalog number, list price, function and description.

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THE NEW SHURE "VERTICAL DRIVE" CRYSTAL PICKUP CARTRIDGES

Big things often come in little packages . . . So it is with the superlative new Shure "Vertical Drive" Crystal Cartridges. They reproduce *all* the recorded music on the new fine-groove recordings—a reproduction that meets the strict requirements of high compliance and full fidelity. The "Vertical Drive" cartridges are requisite for the critical listener—the lover of fine music. They are especially recommended for those applications where *true fidelity* is essential.

**SINGLE MODELS:**  
W 23 A for standard width-groove records.  
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W 22 A and W 22 AB for both standard and fine-groove recordings.

Unusually highly compliant, these "Vertical Drive" Cartridges will faithfully track standard records with a force of only 6 grams—micro-groove records with a force of only 5 grams (an added protection for treasured recordings). Will fit standard or special mountings. Have more than adequate output for the average audio stage.

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Microphones and Acoustic Devices

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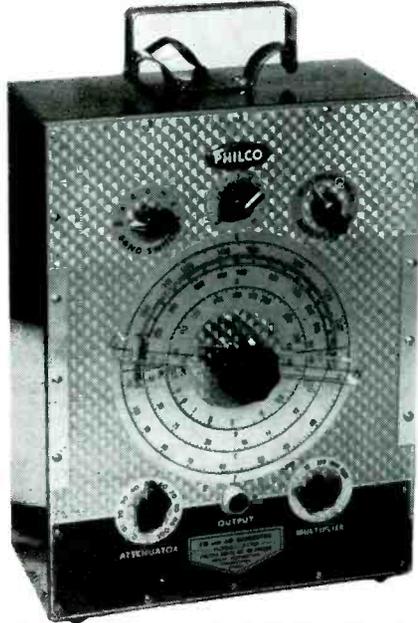
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A \$97.50 Instrument for **\$64.50**



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R.F. (FM)	400 cycles
Audio Frequency	.6—1 volt (r.m.s.), depending upon range
R-F Output Amplitude	1 volt (r.m.s.) approximately
A-F Output Amplitude	Variable from 4 kc. to 500 kc.
Sweep Width	400 cycles
Sweep Rate	60-c.p.s. (fixed)
Calibration	Direct reading (for AM)
FM-Oscillator Frequency	60 mc.
Operating Voltage	110—120 volts, 60 cycles a.c.
Power Consumption	25 watts
Tube Complement	6C4 (1), 7F8 (2), 6X5GT (1)

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## FM Detectors

(Continued from page 22)

phase difference will *increase* when the input frequency is less than the resonant frequency of the transformer. The phase difference will *decrease* when the input frequency is more than the resonant frequency of the circuit.

The discriminator may be considered as a circuit using two diode detectors, each of which have a tuned circuit. As shown, a tuning capacitor,  $C_2$  is used to bring the entire secondary to resonance. The secondary is center-tapped and this point may be considered as equally spaced between the two diode plates. By means of a coupling capacitor, a voltage is fed from the hot end of the primary to the center tap of the secondary. This introduces a signal into the secondary which is *in phase* with the primary signal. A second signal appears in the secondary caused by means of inductance coupling from the primary. The diodes conduct by means of the vector relationship between the directly-coupled signal through the coupling capacitor and the inductively coupled signal from primary to secondary. An *rf* choke is used to prevent the midpoint of the secondary from appearing at ground potential.

A vector relationship can also be used to explain the conduction of this circuit. It should first be noticed that the audio output voltage is equal to the sum of the two voltages across  $R_1$  and  $R_2$ , but these two voltages are connected series-opposing and the larger voltage will predominate as the output. For example, if there is a negative 5 volts and a positive 3 volts, the audio output will be a negative 2 volts. If there is a positive 10 volts and a negative 6 volts, there will be a positive 4 volts as the output.

In Fig. 3, *a*, *b*, and *c* appear the vector relation which can be used to determine the output at any frequency.

In *a* of the figure, the primary voltage is used as a reference which is  $E_p$ . This voltage is not only the voltage across the primary of the transformer, but also the voltage existing between the center tap of the secondary and ground across the *rf* choke. Since this voltage is applied at the center tap of the secondary, it will be equally effective at the plates of both diodes 1 and 2.

The secondary voltage resulting from induction must be  $90^\circ$  out of phase with  $E_p$ , but because the secondary is center tapped, the two diodes will be out of phase, for this voltage. That is, while one plate is going negative, the other plate is going positive. This action is common to any type of center-tapped transformer. If the center tap is considered reference, one end of the transformer must be *plus* while the other end is *minus*. In *a*, illustrating action at resonance, the induced secondary voltage applied to diode 1 is  $E_1$ . The voltage applied to the other diode is  $E_2$ . Diode 1 conducts because of the addition of the two vectors  $E_p$  and  $E_1$ . Diode 2 conducts because of the vector addition of  $E_p$  and  $E_2$ . Both tubes are conducting equally at resonance and the outputs taken across the respective load resistors are both equal and opposite. Since the resultant audio output is taken across both  $R_1$  and  $R_2$  in series, this output is zero at resonance, which is the 10.7-mc *if*.

When the incoming signal is less than 10.7 mc, there is a greater than  $90^\circ$  phase difference between a primary voltage and the secondary voltage resulting from induction. In part *b* of the figure, the secondary voltages at the diode plates are still  $180^\circ$  out of phase. The resultant vector addition for diode 1 means less conduction for this tube than for diode 2. The audio output is now a negative voltage, since diode 1, which has the positive voltage output, is less than the negative voltage output because of diode 2.

Above resonance, illustrated in *c*, the vector relationship is changed and

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there is less than  $90^\circ$  phase shift from primary to secondary, resulting in a greater output across  $R_1$  and a smaller output across  $R_2$ . This means that the total audio output voltage at this instant is positive. Thus, the voltage developed across the output resistor has the same characteristic as the voltage output from the double-tuned circuit. Only the method of causing the diode conduction is different in the discriminator, as compared to the double-tuned detector.

The discriminator is responsive to amplitude variations as well as frequency variations. If the incoming signal is not at resonance, an increase in the amplitude of this signal will cause an increase in the audio output. An increase in the signal strength, for example, means an increase in the voltages applied to both tubes with a resultant greater output. For this reason, the discriminator requires a limiter circuit preceding it in the frequency-modulation receiver. The function of the limiter is to clip the amplitude variations from the FM wave, providing the discriminator with a constant-amplitude variable-frequency input signal.

A plot of the output versus frequency of the discriminator provides the characteristic S curve, common to all modern FM detectors. The diodes have been reversed in the discriminator as compared to our detuned circuit, and an *af* voltage output will be obtained, in which the instantaneous voltage is proportional to the change in frequency.

Above the 10.7-mc resonant frequency, the voltage output across the series resistors is positive since  $V_1$  has a greater output across  $R_1$  than  $V_2$  has across  $R_2$ . Below resonance, the situation is reversed and a greater output is obtained across  $R_2$ , which is negative, than across  $R_1$ , which is positive. This means that the voltage output will be negative below resonance.

The discriminator detector alone is only a part of the entire process of converting the frequency-modulated *if* signal into audio frequency. Intermediate-frequency amplifiers are used to build up the signal until it is large enough to be detected. A limiter is needed to remove amplitude variations from the signal since the discriminator is sensitive to amplitude as well as frequency changes in the signal. The output across the two load resistors in series has an *rc* network for deemphasis. In the FM transmitter, the high audio frequencies are amplified more than the low audio frequencies. This is known as preemphasis, which increases the signal-to-noise ratio for the high frequency. To compensate for pre-

(Continued on page 66)

# Experts choose JACKSON TV instruments for important jobs

IN PRODUCTION WORK AT STEWART-WARNER



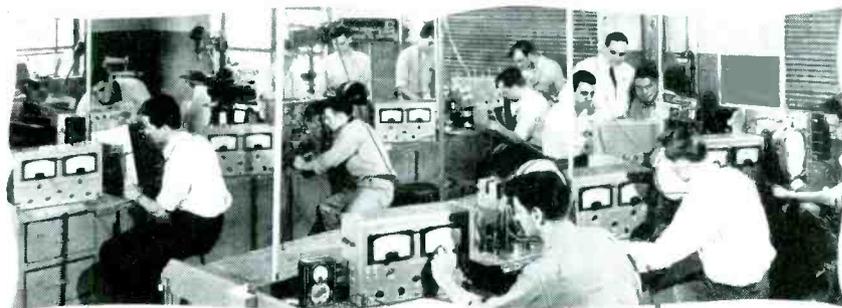
Shown in this typical production scene at Stewart-Warner are some of the Jackson Oscilloscopes used in checking television receivers. Used in various stages of production, these Jackson 'scopes are depended

upon to maintain Stewart-Warner's high production standards. This is only one example of how Jackson's outstanding oscilloscope is used for important jobs in industry, too. Also, many other applications.

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equipment. Shown here are some of the generators used by Deforest's in this important work. Jackson equipment was chosen for its ability to provide accurate results, even under the hard usage encountered in teaching.

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## FM Detectors

(Continued from page 64)

emphasis, an *rc* circuit which discriminates against the high audio frequencies is used between the detector output and first *af* amplifier. This simple network consists of a series resistor and shunt capacitor to ground. The capacitor has a reactance which decreases as frequency increases. In this manner, there is less gain for high frequencies in the receiver to correspond for more gain to the high frequencies at the transmitter.

The FCC regulations state that the audio frequency used for modulation in FM can vary between 30 cps and 15 kc. To take full advantage of this wide audio frequency band, special care must be taken with the audio-frequency amplifiers, output stage, and loud-speaker system.

[To Be Continued]

## Servicing Helps

(Continued from page 39)

placed in series with the transmission line of the offending receiver, sometimes reduces oscillator radiation by as much as 20 times (in voltage). Fig. 2 shows the equivalent circuit that exists when the grid-to-plate tube capacitance of the booster tube is added in series with the capacitance of the *rf* amplifier tube in the tuner. The attenuation of the oscillator signal is thus increased by a factor of *two*.

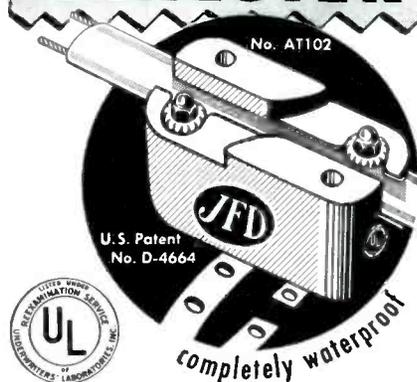
A properly-designed untuned amplifier will give some gain, in addition to providing isolation. The amount of gain obtained is maximum at the lower frequency channels, and about unity at channels 12 and 13.

The use of a tuned booster will be found to increase oscillator-radiation attenuation to a greater degree, since the selectivity of the tuned grid and plate circuits also serves to attenuate the oscillator signal.

In most cases where the interfering signal is of a frequency that falls on the skirts of the *rf* response curve of the receiver being interfered with, the interfering signal can be attenuated appreciably by tuning the booster. This is due to the additional selectivity contributed by the booster, which usually has a narrow bandpass. Some improvement can be achieved without a booster by returning the grid and plate trimmers in the *rf* section of the receiver. Increasing the values of loading resistors will also increase selectivity and improve rejection.

Local oscillators of receivers using the intercarrier sound system are

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much more likely to cause interference, since the fine-tuning control of such receivers may be adjusted, and the oscillator frequency changed as much as 2 mc on the high-band channels, without losing the accompanying sound. This makes for a wide range of oscillator frequencies, and consequently, a greater possibility for interference.

## Square-Wave Generator

(Continued from page 19)

ever, since it does not allow the output circuit to load the flipflop. Output is 2 to 5 volts.

The value of  $C_1$  must be adjusted after the circuit has been put together. The main reason is that its reactance may be too high if very low-frequency input is used. It should be kept as small as possible, however, as with too large values some of the sine may get through to the output through simple amplifier action. It will be noted, too, that the input need not be a sine wave as long as it is reasonably symmetrical. Even better results are obtained, in fact, with an input wave which has steeper sides than a sine wave.

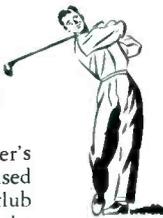
The diagram of Fig. 1a shows the cathode of  $V_1$  grounded. Introducing various values of resistance between it and ground will vary the pulse-width percentage and will produce asymmetric square waves; that is, there is some variation with frequency in any case. Values shown for all components are nominal, not having been checked on a bridge. It may, therefore, be necessary to vary some of them slightly, though in general they are not critical. The .001 and .001-001 mfd units,  $C_2$  and  $C_3$ , in particular, may turn out to be too large for the highest frequencies, producing an imperfect waveform in the output due to too long a time constant.

### Using the Generator

Since the circuit is so small and simple, it can be installed anyplace. It was found that the 'scope itself was the best place since the necessary negative voltage was available there. Fig. 1 shows how input and output jacks (at top left, just next to the *crt*) were installed. The output attenuator was placed just at the right of the tube. The 6SN7GT was located on the chassis under the neck of the *crt*, where there happened to be a clear space. It was found that it wasn't necessary to switch the system off when not in use, because it produces no output when there is no input and draws negligible plate current. The constructor should, of course, make sure the transformer of the

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'scope can stand the extra 600-ma filament drain. Another location that might be even more convenient would be in the sine-wave generator itself. This was not used in this instance because of the absence of the required negative voltage.

Using the device is simple and convenient. As long as the sine-wave input is above the voltage necessary to trigger the circuit, the output voltage remains reasonably constant. The frequency is the same as that of the *af* oscillator.

When the output is coupled to an audio amplifier and the amplifier out-

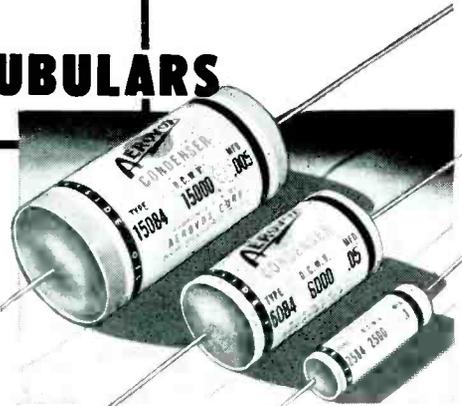
put fed to the 'scope, the resulting pattern will be found to tell most of the story. Fig. 3, for example, shows the pattern obtained through an amplifier deficient in high-frequency response, as indicated by its rounding off the vertical sides of the waves. Treble deficiencies are caused by one or more long time amplifier constants which do not permit fast voltage buildup.

Fig. 4 shows the output from an amplifier with poor bass response. The long, flat tops of a perfect square wave remain at a constant voltage for a considerable period and may be con-

(Continued on page 68)

# HI-V

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## Square-Wave Generator

(Continued from page 67)

sidered to be close to *dc* for that period. Amplifiers with deficient bass cannot pass this quasi-*dc* and the output shows curved flattops, indicating that the voltage during the flattop period did not remain constant.

Many more precise evaluations can be made with the aid of square waves. In general, the square wave contains usable harmonics up to the thirtieth, but more useful tests can be made if only those up to the tenth are depended on. To pass the flat tops perfectly, the amplifier must be flat down to about 10% of the fundamental frequency of the square waves. That means that two frequencies are enough for most audio testing. The band from 30 to 3,000 cycles may be surveyed with a 300-cycle square wave and another examination with a 2,000-3,000-cycle square wave will cover the rest of the spectrum. In any case, it is desirable to know the frequency of the waves, which with the use of this circuit is as accurate as the calibration of the sine-wave generator used.

## Auto Radio

(Continued from page 25)

usually not so necessary. Some housings are unfinished on the ends, and some use a collar or other fitting. When measuring housing lengths, it is important to allow for the depth of the control housings or collars, so that the shafts coming out of the housings will be of the proper length. The overall length of the housing and shaft isn't too critical, but the relationship between the shaft and housing definitely is important. If the shaft comes out too far, it will jam when assembled, and cause binding. Most of them are adjustable in some way, but some aren't. Therefore, they should be inspected carefully before making final adjustments to the length, to be sure that the finished job will work smoothly. One effective way to do the job is to make up one end of the shaft and housing, assembling it into the set or control head, and then measuring the other end. This simplifies the correct measurement.

Shafts may be made to work easier, after installation, by sliding the housing in and out to adjust length, if they are adjustable. Often provision is made for some kind of shaft length adjustment.

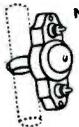
Sometimes you'll find a new shaft on which the fittings are slightly loose. These fittings should be soldered firmly before installation. A little bit of

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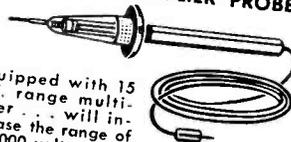
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slack here will soon develop into a very objectionable play in the tuning mechanism. Shafts should be tested before installation by holding one end in a vise and trying to twist it. Any slack or twist means that the shaft is unsatisfactory, and will give trouble if installed in the car.

It isn't usually possible to replace swaged fittings in the service shop, since this requires large and expensive special tools. Soldering for any fitting replacement you want to make is recommended.

#### Various Types of Fittings

There are several types of fittings found on housings, too. The older United Motors sets used a *collar* or *gland* on the set, which had one or two set-screws to hold the housing. Motorola has used a fitting with ears which lock into notches in the set, with a half-turn. Some Motorola control heads used a spring catch affair. These must be carefully set, to make them hold. If they work loose, it is often impossible to make any repairs. When installing the set, some solder can be dropped behind the loop in the catch, and it will hold pretty well. Some auto setups used a split collar, somewhat like a lathe-chuck in appearance, with a threaded collar which tightened the halves together and clamped the housing firmly. Others used a threaded collar with a locking ring.

#### Control Shaft Testing

All control shafts should be tested with the hands before installing. If there is any stiffness, lubrication with light oil or *Lubriplate*, should be applied, working the oil well down into the shaft. If you can get the shaft out of the housing, all the old grease and dirt should be wiped off and then you can relubricate. If the shaft is not *demountable*, and is too stiff to work well, the whole thing should be thrown into a bucket or tub of kerosene and allowed to soak overnight. This will usually result in loosening and the dirt will flush out.

#### What to Avoid

Sharp bends in the housing itself must be avoided. These must be straightened out, as they will cause binding and eventual wear on the shaft itself. They're usually found near the fittings, and on the set end of the cables.

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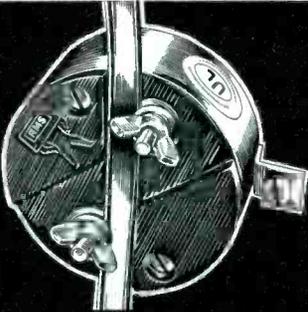
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BEGINNERS! Check here for facts on PRE-TV radio course.

Loose strands or *frazzled* ends of the shafts must be repaired. If left in, they will cause trouble. If they're pretty close to the end, they may be sweated with solder, and ground down smooth. If they pop up in the center, the same method may work. If too many strands are broken, the shaft should be replaced. When the break is close to the end, the shaft may be cut off and the fittings reinstalled, if the overall length will permit. Whenever broken shafts are replaced, the old pieces should be saved. Several Chevrolet sets, and some Philcos, use short

flexible shafts to operate dial and volume controls, in the single-unit jobs. These are about three or four inches long, and may be made up out of scrap pieces of old shaft, if necessary. The Crowe remote controls used on numerous sets use a short flexible shaft to drive the pointer from the worm-gearing on the tuning shaft. This may also be made up out of the old scrap shafting. If you can't find anything to make the sleeve on the end, solder should be sweated into it for about an inch and a half. Grinding or filing to a smooth finish should follow.



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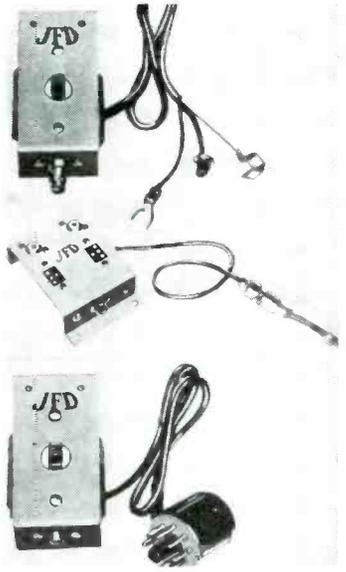
**Phono**

(Continued from page 29)

extra mechanical loading. There is said to be no added distortion caused by new resonance and its sub-harmonics created by the unused needle, nor any needle set-down error in needle replacement.

**Output**

Output is 1 volt for 3-mil tip on the Columbia 10,004 test record and 1 volt for 1-mil tip on the RCA 12-5-31 V test record. Has a tracking force of 8 grams on both needle tips. Response



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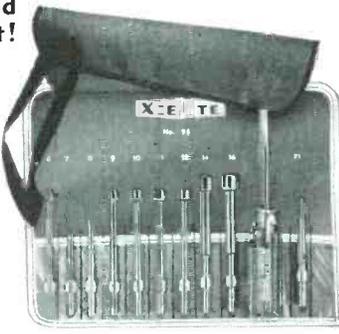


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is said to be out beyond 10,000 cps on either tip.

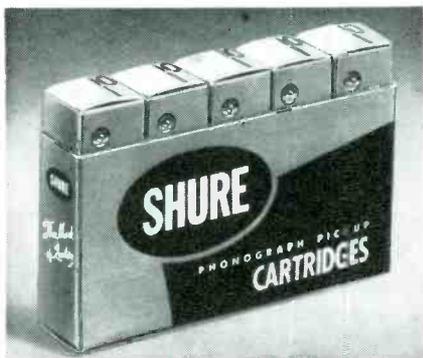
### Radio-Phono Switches

A line of radio-phono switches which can adapt 78, 45 and 33½ rpm record players for use with standard receiver outputs has been announced.

### Universal Player Selector

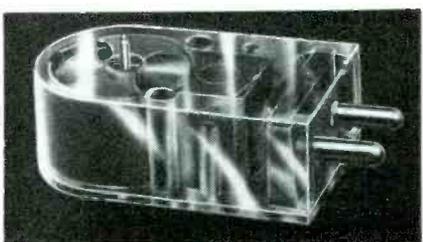
One model<sup>13</sup>, a universal record player selector, permits use of a single sound system or radio for any 78 rpm, 45 rpm and 33½ rpm record player. Equipped with a special cable adapter, it fits either a 3-pin receptacle or coaxial phono-jack. Other radio-phono switches<sup>14</sup> are designed to connect 78 rpm, 45 rpm and 33½ rpm players to radios not equipped with phono-jacks.

<sup>13</sup>ST144: JFD. <sup>14</sup>ST145 and ST184: JFD.



A cartridge sleeve, which holds five cartridge cartons, recently developed by Shure Brothers, Inc. The sleeve, which facilitates arrangement for easy stock rotation, whether in a drawer or on a shelf, also simplifies cartridge packing and wrapping.

Clear-plastic cased variable reluctance pickup designed by The Clarkstan Corp. Pickup, model 204, has a removable stylus which is interchangeable so that microgroove, standard, and transcription recordings can be played. Styli are available with ball points. Cartridge weighs 14 grams (½ of an ounce) and is 1½" long.



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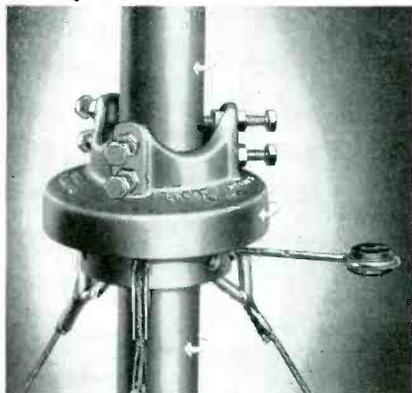
At signing of contract with Television Engineers, Inc., and Radio Television Supply Corp., in Chicago, providing for the installation of Brach Mul-Tel master TV systems in Chicago buildings at no cost to Chicago landlords. Left to right: Ira Kamen of Brach, Morton Binder, TE prexy and W. L. Burge of RTSC. These service companies have both developed a plan for installing the system in multiple dwellings on a basis where all collections are made from tenants. The tenant costs under these plans may be less than \$25 per outlet connection.

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## Center Frequency

(Continued from page 42)

erance or to .005% below 50 mc and .0025% above.

There are several types of equipment which have been developed to do the job. Of all, the heterodyne has been found to be the most versatile type, in that an infinite number of frequencies can be measured with it. In one instrument,<sup>2</sup> featuring the use of the heterodyne principle, the fundamental frequency lies from approximately 2,350 to 2,650 kc.

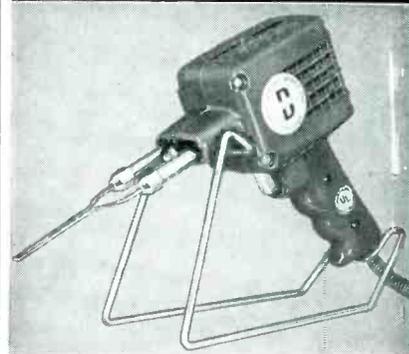
The oscillator in this instrument is rich in harmonic content, and harmonics as high as the 70th are used. When used in measuring transmitter frequencies, harmonics of the transmitter and harmonics of the *mfm* may be used to extend the range of the instrument continuously from 0.1 to 175 mc.

The heart of this instrument is a micrometer tuning capacitor and the circuit of the variable-frequency oscillator. The rotor of the micrometer capacitor is directly mounted on a machinist's micrometer head, and capacitance is varied by turning the micrometer head in or out. The integral number of turns in and out are recorded by a Veeder counter and a total of about 42' of dial spread is made available in this manner. The stator of the micrometer capacitor and the support pieces of the stator are made partly of brass and partly of steel, and are copper plated to prevent corrosion. The difference in thermal expansion of the brass and steel pieces acts to give very nearly a zero temperature coefficient of capacitance.

The tank coil, or resonating conductance, used in conjunction with the micrometer capacitor, is of interest also. The coil form is of polystyrene and about one inch in diameter. There

<sup>2</sup>Lampkin micrometer frequency meter.

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are six ridges along the outside periphery, on which wire is wound. The coil cross section takes a form intermediate between a hexagon and a true circle. Since the coefficient of expansion of the copper wire and the polystyrene form are vastly different, radial and axial expansion of the polystyrene form, coupled with lineal expansion of the wire, act to change the cross section form so that again, the over-all temperature coefficient of inductance is very nearly zero.

These two components are used in what is termed a *ratio-coupled oscillator*, Fig. 1. The grid and plate (screen and suppressor grids) of the 6J7 oscillator are tapped quite far down on the inductance. An interesting feature of this circuit is the fact that all tube capacitances shunt only a very small portion of the tank and therefore a change of tube, or tube heating (with resulting change of interelectrode capacitance) makes little or no difference in the calibration of the oscillator. (This effect has also been accomplished by tapping down in the capacitance side of the tank circuit, the development being made by Clapp).

The crystal calibrator circuit utilizes an ingenious method of temperature compensation. The quartz crystal is mounted in thermal contact with

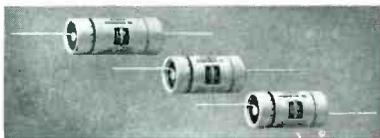
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an alcohol thermometer. The scale on the thermometer is in *mfm* dial readings, which show the *vfo* calibration point. A temperature run is made on each crystal from about 32° to 120° F, to determine its oscillating frequency. These readings are engraved on the thermometer scale. Briefly, here is how the system operates. Let us suppose that the meter is at 65° F. At this temperature the crystal will oscillate at a predetermined frequency. The *vfo* will oscillate at this same frequency, at a certain dial reading. Assuming the *vfo* calibration to be correct with respect to WWV, this certain dial reading has been engraved on the thermometer scale. Now, at any future time if the *vfo* is off calibration, we can properly trim it by observing the thermometer, setting the dial of the *vfo* to this reading, and trimming the *vfo* to the crystal. Incidentally, each instrument is individually checked in a heat run. The complete instrument is placed in a hot box to make certain that this calibration is correct.

Fig. 5. Heterodyne-type band-spread micrometer frequency meter, which has a variable-frequency calibrated oscillator, untuned one-tube detector, a crystal calibrator and a rectifier-filter system.



### Picture-Tube Conversion

(Continued from page 15)

a deflection angle of up to 55°. Hence, 12-inch tubes, of the type shown in Table I (p. 79), which have 17/16" necks, can be used to replace the 10-inch picture tubes without serious modification. If possible the anode voltage should be increased to the values shown in the table. Most sets have high voltage circuits which can be adjusted to provide the slightly higher voltage required.

Tubes with larger diameter than 12 inches usually require larger deflection angles which increase from 50° to 60°, 65°, and 70°. The only large tubes which retain a small angle of deflection and, therefore, permit the use of the deflection coil in an existing 10-inch set, are the 16AP4 (metal), 16LP4, and 16LP4A. The angle for the 16AP4 is 53° while the latter two have deflection angles of 52°. In order to use the smaller deflection angle, these tubes are considerably longer than the 10-inch

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tube, employing the principles indicated in Fig. 2. Hence, a cabinet must be procured that can accommodate the larger tube size.

An anode voltage of 12,000 is required for these tubes. Increasing the high voltage to this potential means that a larger driving voltage is re-

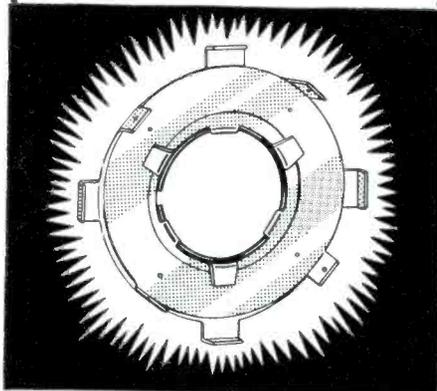
(Continued on page 74)

(Right)  
At landing of Northwest Airlines planes at LaGuardia Field with 25,000 pounds or 26-million feet of aluminum for JFD, left to right: Northwest Airlines senior agent Al Evans; Edward Finkel, sales manager and Al Finkel, vice president of JFD, respectively; and Wes Craig, New York representative for the Kaiser Aluminum Co., which shipped the tubing from Spokane, Wash.

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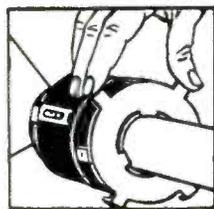


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## Picture-Tube Conversion

(Continued from page 73)

quired to keep picture at the same size. The schematic of a circuit that can be used to supply the necessary high voltage and driving current for these tubes appears in Fig. 3.

The transformer<sup>2</sup> used in this circuit is a powdered iron-core type, designed to give ample driving deflection between a 6BG6 and the deflection yoke type previously described. By furnishing an extra filament winding, this transformer can be used in conjunction with a voltage doubler circuit to give a no-load voltage of 13,500 volts.

### Operation of Voltage Doubler

A simplified schematic illustrating the operation of the voltage doubler is shown in Fig. 4; p. 76. The high voltage pulse developed across the coil in the plate circuit of the 6BG charges  $C_1$  up to a value of  $E$  since  $V_1$  is conductive. Between pulses, with  $V_1$  cutoff,  $C_1$  charges  $C_2$  through resistor  $R_1$  and after a number of cycles  $C_2$  charges up to  $E$  volts. Now, when charging pulse  $E$  is again applied across  $V_1$ , a voltage of amplitude  $2E$  exists across  $V_2$ , because of the charge in  $C_2$ .  $C_3$ , which has been charging slight all along, now also charges to  $E$  volts. The voltages across  $C_1$  and  $C_3$  are in series and will add up to  $2E$ . Thus, the potential of the  $V_2$  cathode becomes equal to  $2E$ , with respect to ground.

The action may be summarized as follows: Over the duration of the pulse  $C_1$  and  $C_3$  are charged up through  $V_1$  and  $V_2$ , respectively. In between pulses,  $C_1$  charges up  $C_2$ , so that the plate voltage of  $V_2$  will be sufficiently positive to overcome the bucking voltage across  $C_1$  and charge  $C_3$  to  $E$  volts. The voltage across  $C_2$  and  $C_1$  add to provide a po-

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tential of  $2E$ .  $C_1$ ,  $C_2$ , and  $C_3$  are each 500-mmfd capacitors with a voltage rating of 10,000.

An output of 13,500 volts is obtained from this circuit under no load conditions. With an anode current of 200 microamperes the voltage drops to 11,500.

Returning now to the Fig. 3 circuit, the input driving voltage applied to the 6BG6 should be about 70 volts peak-to-peak. To obtain maximum linearity a peaking circuit, comprised of  $C_5$  and  $R_4$ , is incorporated to provide a negative peaking pulse of proper width. Since this is a feedback circuit, trouble may occur due to regenerative feedback. In this instance, a capacitor of from 500 to 1000 mmfd should be placed between the potentiometer arm and ground. The best value of capacitance should be determined experimentally with the circuit in operation.

The peaking control,  $R_4$ , should be adjusted carefully to avoid excessive current in the 6BG6. It is recommended that, initially, a meter be placed in the cathode circuit of the 6BG6 and the peaking control adjusted for a reading of about 100 ma. Similarly, the driving voltage should not be made too high, for the voltage developed will exceed the picture-tube rating and may damage the tube. The driving control (in grid of previous stage) should be adjusted to obtain a peak-to-peak voltage of about 70.

#### Wide Deflection Circuits

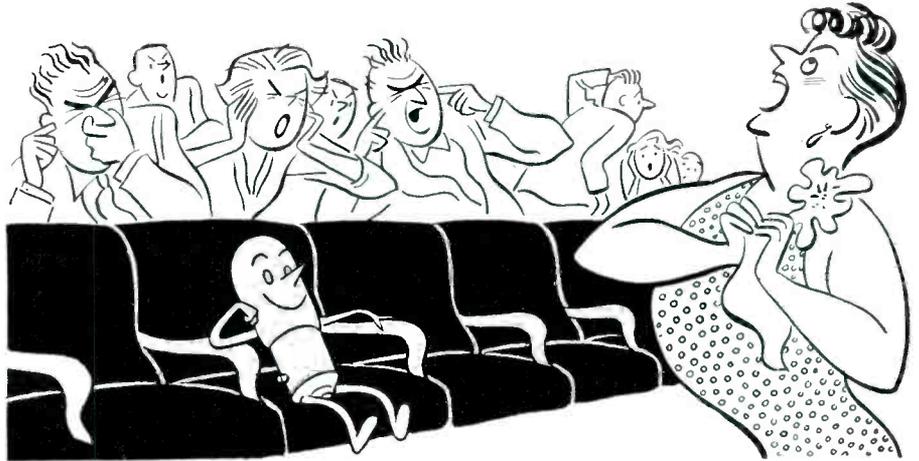
The remaining types of picture tubes, over 12 and up to 19 inch, including rectangular tubes, have greater deflection angles ranging from  $55^\circ$  to  $70^\circ$ . To obtain an increased deflection wider angle yokes must be used. Two types of deflection yokes<sup>a</sup> have been used with these tubes. The yoke used must match the driving transformer. In addition to the wider angle, these tubes also generally require higher anode voltages. Both of these problems can be usually solved by a single high-voltage circuit which also matches into a given wide degree yoke.

One such circuit is shown on the cover, where a new 6CD6G driving tube has been used in place of the 6BG6. This tube is a beam power amplifier with high plate current at low plate voltages and a high operating ratio between plate and screen

<sup>a</sup>RCA 206D1 designed for use with RCA 218T1 flyback deflection transformer; Todd Transformer J70 series designed to accommodate different deflecting transformers.



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grid currents. A unique feature of this circuit is that it rectifies one winding of the flyback transformer and adds about 150 volts to the normal  $B+$  supply of 350 volts, so that an output of approximately 500 volts can be obtained. This increased voltage is also used for the discharge tube and vertical drive circuit to obtain greater driving voltages. The driving voltage required for the 6CD6G is somewhat larger than in the deflection circuit for a smaller tube. Fig. 5 shows the desired input voltage waveform and, as indicated, a peak-to-peak voltage

of approximately 130 volts is required.

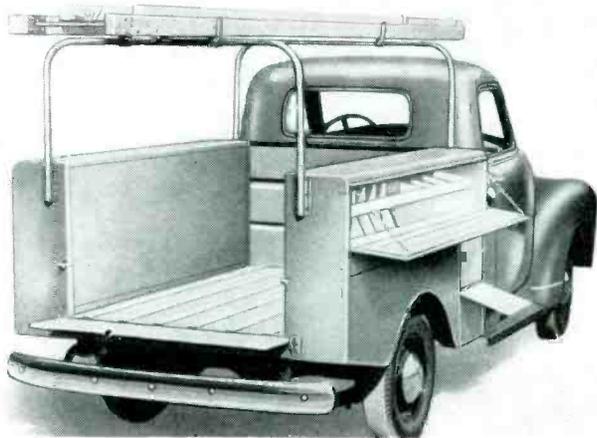
The increased driving power is obtained by use of the 500-volt supply incorporated in this circuit. However, in some cases, 500 volts may exceed the maximum plate voltage of the discharge or vertical driving tubes. A dropping resistor must be therefore inserted in series with the supply line. Initially a 5,000-ohm rheostat with 15-watt capacity should be used. And, starting with 350 volts, the control should be varied until the minimum voltage that will result in sufficient

(Continued on page 76)

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## Picture-Tube Conversion

(Continued from page 75)

driving power is determined. The value of resistance that provides this minimum voltage can be measured with an ohmmeter. A fixed resistor with this value, and a power rating of 10 watts, can then be inserted in the circuit.

The high voltage (14,000 volts), is again obtained through the use of a voltage doubler circuit, the operation of which is similar to the system shown in Fig. 4. The only exception is that  $C_1$ , which corresponds to  $C_2$  in Fig. 4, is not connected to  $C_3$  and consequently is charged up to  $2E$ . Hence, the rating of this capacitor must be increased to 20,000 volts. This circuit delivers a voltage

of 14,000 under no-load conditions and 12,300 volts with an anode current of 140 microamperes.

### Vertical Circuits

The vertical deflection circuits for the 10-inch sets possess enough extra

drive to be used satisfactorily with larger  $52^\circ$  and  $53^\circ$  tubes. Hence, for these tubes vertical deflection circuits do not present any problem. For the wider angle tubes the only real problem is to obtain sufficient drive and the circuit presented on the cover for the wide angle tube provides a

Fig. 4. Simplified circuit of a voltage doubler appears in (a). In (b) we have the time relationships between the high-voltage pulse and the sweep current.

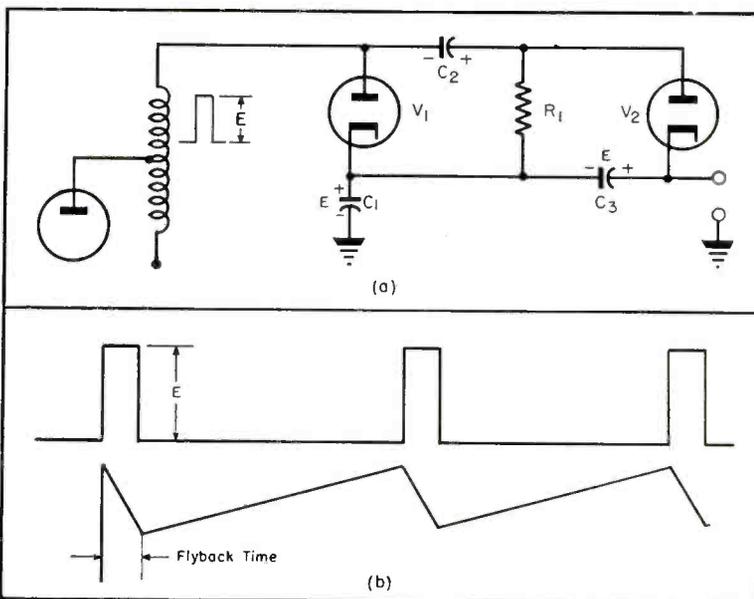
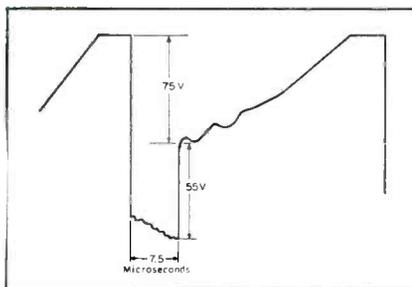


Fig. 5. Grid-input waveform to the 6CD6G.



higher plate voltage supply for this purpose. It is also advisable, in this latter case, to use a vertical output deflection transformer<sup>4</sup>.

#### Mechanical Considerations

The mechanical problems that arise are individual for each chassis and depend to some degree upon the type of tube used. Where longer length tubes are substituted for the original one, a new cabinet is usually required. If a new cabinet is necessary, provision should be made for mounting the tube upon the focus coil support. If it is not feasible to mount focus coils supports in the cabinet, or the old cabinet is used, it will be necessary to employ a bracket to fasten the tube to the chassis. In all cases the tube must be anchored solidly with no strain on the neck.

Provision must also be made for adding the voltage-doubler circuits. In general, the new flyback transformer can physically replace the removed transformer. The main problem is the addition of one 1B3 tube (one is already in the set). In most of the old models there is ample room for mounting this tube in the high voltage section. In mounting this tube it is necessary to observe the same insulation precautions taken with the tube already in the set. With a little ingenuity the Service Man should be able to fit all the components in the available space.

When metal tubes are used several additional precautions must be taken. The tube must be free of dust and moisture particularly at the junction of the metal and glass; otherwise a leakage path will exist. Furthermore, the metal lip on the face of the tube should be mounted at least 1.5" away from any ground to prevent arcing.

Some tubes require ion traps which should be adjusted carefully in accordance with manufacturer's instructions to obtain optimum performance and avoid damage to tube.

#### Projection Techniques

Pictures up to 30 by 40 inches can be obtained from 10 inch (or larger) sets through the use of projection techniques.

Through the use of one system<sup>5</sup> no modification of the existing chassis is necessary. In fact, with one unit<sup>6</sup>, pictures can still be obtained on the original tube. In many homes there is no serious objection to small screens when only one or two persons are

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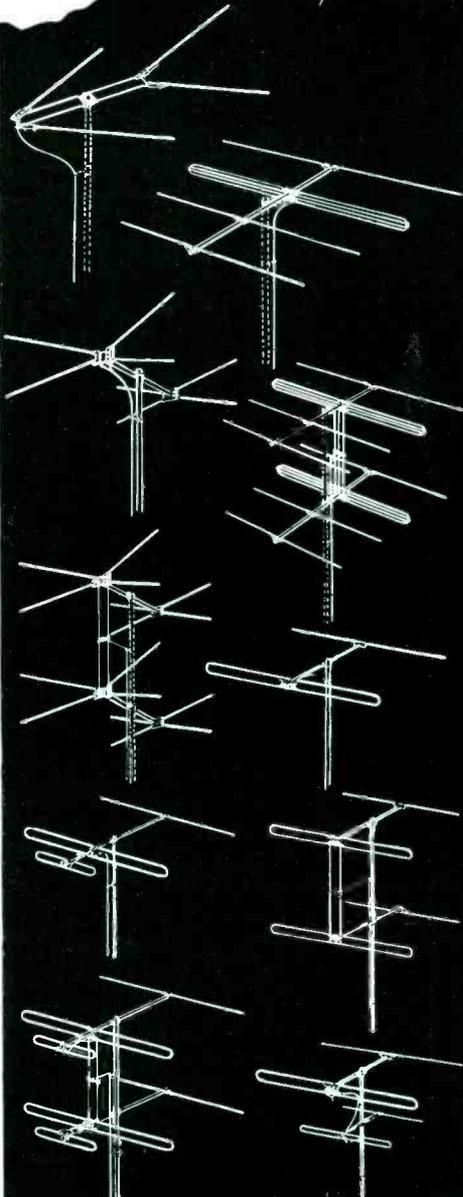
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viewing the set. Under these conditions this unit will display the picture on the original 10 (or larger) inch tube as before. When big pictures are desirable, the set can be moved from the wall, a switch turned to *projector*, and a large picture projected on the screen.

If a larger picture is preferred at all times, the unit shown on page 14 can be used. Other ingenious arrangements have been developed, such as

placing the 10-inch receiver in the den and the projected picture in the living room. The system is completely flexible and can be adopted to any personal requirements.

The projection system is supplied as part of a complete kit. A number of different kits are available to cover the various sizes and methods of displaying the picture. The elements that make up these kits can be secured individually. For example, the cabinets which house the additional units and viewing screen can be assembled

*(Continued on page 79)*

<sup>1</sup>RCA 222TL.

<sup>5</sup>Protelgram. <sup>6</sup>Duo-Vue.

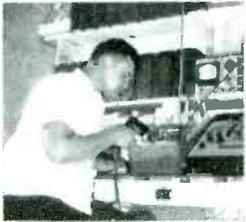
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# Rep Talk

SAMUEL A. JEFFRIES, a charter member of the Mid-Lantic Chapter of *The Representatives*, has opened new offices in the commerce Building, 105 Forrest Avenue, Narberth, Pennsylvania. The new office will operate as the main office with J. E. Douglas in charge. The Philadelphia office, 1513 Packard Building, will continue as a branch office, under the direction of M. E. Kerns. . . . *Walter C. Hustis*, Florida Road, Ridgefield, Conn., is now a senior member of the New England chapter of the *Reps.* . . . *George Davis*, Los Angeles, has been named factory rep for the California Chassis Co., South Gate, Calif. . . . *Maury E. Bettis Company*, 3119 Gillham Road, Kansas City, Mo., has been named Astatic rep in Missouri, Kansas, Nebraska and Iowa. . . . *Henry Lavin Associates*, P. O. Box 196, Meriden, Conn., have been appointed sales reps for Radiart in the six New England states. Firm also maintains a branch office at 436 Dedham Avenue, Needham, Mass., under the supervision of Robert V. Curtin. . . . *Ranson, Wallace and Co.*, 116½ East Fourth St., Charlotte, N. C., are now sales reps for Sola Electric in Virginia, North Carolina, and South Carolina. . . . *Harold A. Chamberlin*, VEE-D-X antenna rep, recently celebrated his fifth anniversary with the company. Chamberlin covers New England and upper New York State and his office is in Boston. . . . *Frederick H. Stern*, 130 West 42nd St., N. Y. C. is now a rep for Aero Electronic Hardware Corp., Union City, N. J., and Met-L Products Corp., Long Island City, N. Y. Stern will cover the New York area for both firms. . . . *Henry D. Sarkis*, has moved his offices to 6560 N. Sheridan Road, Chicago 26, Ill. Sarkis is an industrial rep for Jeffers Electronics Inc., and Speer Resistor Corp., in Southern Ill., Ind., O., and Mich. . . . *Ira L. Arkin Co.*, 412 North Orleans Street, Chicago, Ill., have been named Brach reps in the Chicago area. . . . *W. Bert Knight Co.*, have moved to their own building at 10373 W. Pico Blvd., Los Angeles 64. The firm covers the southwest area. . . . *R. Gordon Dougherty*, former sales rep for the Jensen Manufacturing Co., is now handling distribution of the Regency booster for I.D.E.A., Indianapolis, Ind. Dougherty's territory is O., W. Penna., and W. Va. . . . *S. W. Goodman*, Baltimore, Md., has been named by Allied Electric Products to cover the states of Md., Va., and the District of Columbia. *Allen B. Carpenter Co.*, Denver, Col., has been assigned the territory comprising Ariz., N. M., El Paso, Texas, Col., Wyo., Utah and Mont. Appointment also includes representation and warehousing of the line of Sheldon TV picture tubes made by Sheldon Electric, a subsidiary of Allied Electric. . . . *Tel-A-Ray Enterprises, Inc.*, Henderson, Ky., has appointed the Conrad R. Strassner Co., Los Angeles, to represent it in Calif., Ariz., and N. M. . . . *Vitramon, Inc.*, Stepney, Conn., has ap-

pointed the *G. S. Marshall Co.*, Pasadena, Calif., to represent it in N. M., Ariz., and Calif. . . . *Wesley L. Wilson* has become Chicago sales rep of the Selenium-Intelin Division of Federal Telephone and Radio Corp. . . . *Jerry Burnett* has joined Cliff Landis, Corn Exchange Bank Bldg., 81-11 Roosevelt Ave., Jackson Heights, N. Y. Burnett will cover the jobber and industrial trade in metropolitan N. Y. . . . The Oxford Electric Corp., has announced the appointment of the *Egert & Fields Co.*, 11 Park Place, New York, as rep in the New York territory. . . . *Jack Thorpe*, 4390 Haverhill Avenue, Detroit, Mich., will cover the entire state of Michigan for Standard Coil Products, taking over this territory from Harry Halinton of Chicago, who will continue to serve Northern Illinois and Eastern Wisconsin. *Fred Larrabee* of Kansas City has had his territory expanded to include all of Missouri and Southern Illinois. . . . *M. P. Mack*, 1427-16th Street, Denver, Colo., is now Oxford Electric jobber and distributor sales rep. in the Rocky Mt. area.



Henry Lavin



Harold A. Chamberlin

### STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933.

OF SERVICE, published monthly at New York, N. Y., for October 1, 1950.

State of New York } ss:  
County of New York }

Before me, a notary, in and for the State and county aforesaid, personally appeared B. S. Davis, who, having been duly sworn according to law, deposes and says that he is the Business Manager of SERVICE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit: 1. That the names and addresses of the published, editor, managing editor, and business manager are: Publisher, Bryan Davis Publishing Co., Inc., 52 Vanderbilt Avenue, New York 17, N. Y.; Editor, Lewis Winner, New York, N. Y.; Managing Editor, None; Business Manager, B. S. Davis, Ghent, N. Y.; 2. That the owners are: Bryan Davis Publishing Co., Inc., 52 Vanderbilt Avenue, New York 17, N. Y.; B. S. Davis, Ghent, N. Y.; J. C. Munn, Cleveland, Ohio; A. B. Goodenough, Port Chester, N. Y.; P. S. Weil, Great Neck, N. Y.; F. Walen, Teaneck, N. J.; G. Weil, Great Neck, N. Y.; L. Winner, New York, N. Y. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities, are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock, and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) B. S. DAVIS, Business Manager.  
Sworn to and subscribed before me, this 6th day of September, 1950.

(Seal) NATHAN JELLING,  
Notary Public.

Commission expires March 30, 1952.



R. Gordon Dougherty

## Picture-Tube Conversion

(Continued from page 77)

by the Service Man or purchased as a complete unit from the manufacturer.

A projection kit consists of three major elements: the projection system, adaptor, and cabinet. The heart of unit is the projection system which includes a 25,000-volt supply, a 2.5-inch picture tube, and an optical box.

The 2.5-inch tube is operated with an anode voltage of 25,000 volts (obtained from high voltage supply) thereby effecting a very bright, sharp image. This image is directed to the spherical mirror which focuses the beam to the inclined mirrors. The image is reflected from these mirrors through the corrector lens and on to the viewing screen. The deflection circuits for the picture tube are derived, via the adaptor unit, from the original receiver.

The adaptor unit is supplied to assure optimum performance with almost any TV set employing magnetic deflection. It contains a well filtered B+ and filament supply for the 25,000-volt unit, a compensated video amplifier to develop additional driving voltage for the picture tube, a deflection protection circuit which biases the picture tube to cut off in the event of deflection failure (otherwise a spot or line may burn into tube face), auxiliary focus and brightness controls, and the necessary terminal blocks for the interconnecting leads.

The viewing screen is flat and square cornered and looks like a piece of ground glass. The picture is formed on its back side and seen through. If proper precautions are taken to minimize light losses in the system, adequate brightness, contrast, and resolution are easily obtainable.

A schematic of the *Duo-Vue unit* appears on page 16. Leads to appropriate power, video, and deflection circuits carry required voltages to the system and adaptor units. The units are placed in the cabinet and are interconnected via cables supplied with kit. It has been found possible to make the entire installation in about one hour.

Tube Type	Deflection Angle	Anode Voltage
12JP4	52°	12,000
12KP4	54°	10,000
12QP4	55°	10,000

Table 1

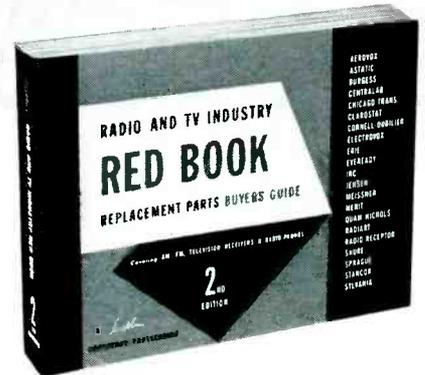
List of 12-inch tube types which can be used to replace 10B4, which has a 50° deflection angle and voltage of 9,000, directly without circuit modification.

## JOTS AND FLASHES

THAT HEAVY DEMAND FOR SERVICE MEN, which a few months ago was just a prediction, has become quiet an actuality, with even thousands more needed than originally prophesized. In the opinion of one service expert, an additional 10,000 Service Men will be required to install and service the two-million receivers which industry will produce and sell between now and the end of the year. Speaking before the Electric Institute of Boston, E. C. Cahill, president of the RCA Service Co., said that the incredible speed of television's growth from less than 200,000 units produced in '47 to over eight million in '50 has produced quite a service problem, complicated by the fact that it takes quite awhile to train a Service Man to full competence, and government agencies are drawing heavily on trained electronic technicians for top priority work. . . . The bulk of TV picture tube production at DuMont is now in 17" rectangulars and 19" rounds. . . . A new plant has been opened by Raytheon in Quincy, Mass., for the production of subminiature and miniature tubes for the military at present, and perhaps commercial requirements subsequently. . . . The Radio Craftsmen, Inc., have acquired 12,000 square feet of space at 4401 N. Ravenswood, Chicago, Ill. . . . Cornish Wire Co., Inc. has moved to new offices at 50 Church St., New York 7, N. Y. . . . A series of TV spot commercials, describing the Tenna-Rotor, is now underway over about fifty stations, from coast to coast, under the sponsorship of the Alliance Manufacturing Co. . . . Warren E. Albright is now manager of the general materials division of the RCA Home Instrument Department. . . . The new '51 edition of *Radio's Master*, a 1200-page manual and buying guide of electronic equipment, is now being advertised widely by Federated Purchaser, Inc., 6 Dey St., New York 7. . . . Charles C. Koch of the Merit Transformer Corp., Chicago, is now president of a new manufacturers' association. The group, to be known as The Electronic Parts Manufacturers Association, has as members around forty manufacturers of transformers, capacitors, resistors, coils and other components. . . . Dominic R. Siragusa, head of Molded Products Corp., Chicago, and brother of Ross D. Siragusa, Admiral Corp. prexy, died recently. . . . Lawrence C. F. Horle, former chief engineer of the data bureau of the RTMA, died a few weeks ago. . . . DeMambro Radio Supply Corp., Inc., have opened a new store at 222 Summer St., Worcester, Mass. . . . M. B. Patterson and John Leedom have formed a new distributor organization, Wholesale Electronic Supply, at 2800 Ross Ave., Dallas 1, Texas. . . . A four-page bulletin describing solderless connectors for electrical wiring has been released by the Buchanan Electrical Products Corp., 1290 Central Ave., Hillside, N. J. . . . A 130-page parts catalog has been published by Sun Radio and Electronics Co., Inc., 122-124 Duane St., New York City. . . . The third issue of *Telrex News* recently published contains data on TV reception problems, installation-service hints, etc. Detailed in a column covering reception problems are the methods that can be used to measure antenna sensitivity. . . . A 128-page

(Continued on page 80)

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## Jots and Flashes

(Continued from page 79)

booklet describing the elements of single and dual track magnetic tape recording has been published by the Twin-Trax Division of the Amplifier Corp. of America, 398 Broadway, New York 13. Presented are twenty-one chapters covering such subjects as erasing, highlights of typical recorders, tape transportation mechanisms, etc. Also offered is a listing of over 1000 suggested applications for magnetic tape recording. . . . A 12-page bulletin, in which the characteristics of 194 types of cathode-ray tubes for TV receivers and 'scopes are tabulated, has been published by Sylvania Electric. . . . Morton Binder has succeeded Irving Kaluzna as president of Television Engineers, Inc., 1539 W. Harrison St., Chicago. A TE service branch has been opened at 311 East 79th St., Chicago.



Morton Binder



In the TVI article by Ira Kamen presented in the October issue of SERVICE, an FM interference picture was shown. Unfortunately, the wrong plate was published. Above appears the correct illustration showing patterns which appear when an FM beat is picked up on TV. In this instance, the beat was picked up on channel 7.

(Courtesy DuMont)

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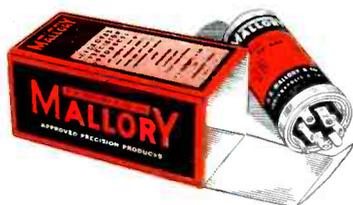
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